Investigation of Nutritional Composition and Ascorbic Acid Retention in *Brassica oleracea* L.

ThidaKyaw[1], KhinNannNyuntSwe[2], Thida Tin[3]

Abstract

*Brassica oleracea*L.is usually consumed as a vegetable and has properties that are beneficial for human health. This study was performed to investigate the phytochemical constituents, nutritional composition, ascorbic acid retention and mineral contents of *Brassica oleracea*L..The phytochemical constituent of *Brassica oleracea*L.sample was examined by test tube method. AOAC method was used to determine the nutritional compositions in this sample. The amount of ascorbic acid andascorbic acid retention in *Brassica oleracea*L.juice was investigated by iodometric titration method. Furthermore, the antioxidant activity of crude ethanol extract was evaluated using 2,2´-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay. Finally, the mineral contents in this *Brassica oleracea*L. sample were detected by Energy Dispersive X-Ray Fluorescence Spectroscopy (EDXRF).

Keywords: broccoli, phytochemical, nutritional, ascorbic acid, EDXRF

Introduction

Diet rich in fruit and vegetable has long been associated with reduced risk of chronic disease, particularly cardiovascular disease, cancers and type 2 diabetes (Faller and Fialho 2009). Fresh vegetables are a store house of vitamins such as beta carotene, ascorbic acid, folic acid and riboflavin as well as minerals such as iron, calcium and phosphorous. The major antioxidants present in fruit and vegetables are vitamin C, vitamin E, carotenoids and polyphenols, especially flavonoids, which all provide protection against free radicals (*Monero et al.,2010*). The quality and quality of these antioxidant components in fruit and vegetables are major attributes to the health benefits of human beings.

Broccoli belongs to the *Brassica* genus and is renowned for its vast range of non-enzymatic bioactive compounds, being rich in nutritional composition,vitamin C and E.Vitamin C which includes ascorbic acid protects against cell death, directly scavenges superoxide radical and acts as a lipid peroxidation chain-breaking agent(Gliszczynska-Swiglo*et al*.,2006). Vitamin C intake may be particularly helpful to smokers, as they are more likely to suffer from oxidative stress.

Broccoli (*Brassica oleracea* L.) originated in Europe Eastern Mediterranean coast, Italy, a small amount of cultivation in china in recent years, primarily for use by food, due to its nutrient-rich, excellent taste, is recommended as the topten by the time Magazine ranks fourth in health food. Broccoli contains in rich amounts proteins, potassium and calcium but very low in sodium. Broccoli contains more vitamin C than cabbage, tomato, especially in terms of prevention and treatment of gastric cancer and breast cancer. Variation in both cooking treatment and cooking duration may affect the nutritional value of vegetables. Broccoli is normally cooked by boiling in water or microwaving before consumption; thus, it is essential to determine which retaining ascorbic acid in this vegetable.

The aim of this study was to investigate the nutritional composition and ascorbic acid retention in Broccoli. Ascorbic acid is the most difficult of the vitamins to preserve during blanching. Blanching is a cooking process where in the food

[1]Dr, Associate Professor, Department of Chemistry, Yadanabon University
[2]Dr, Associate Professor, Department of Chemistry,Monywa University
[3]Dr, Associate Professor, Department of Engineering Chemistry, Mandalay Technological University

substance, usually vegetable or fruits, is plunged into boiling water, removed after a brief, timed interval, and finally plunged into iced water or placed under cold running water to halt the cooking process (Muftagil N, 1985).

Figure 1.*Brassica oleracea* L.(Broccoli)

Materials and Methods

Sampling and general experimental techniques

Brassica oleracea L.(Broccoli) was collected from Shan-lay-kyun village, AmarapuraTownship, Mandalay Region.Broccoli sample was cut into small pieces and air dried at room temperature. This sample was ground into powder in an electric blender and stored in airtight container. Preliminary phytochemical constituent was investigated by test tube method. Nutritional values were determined by AOAC method. The vitamin C content of this sample was analyzed by iodometric titration method. The antioxidant activity of broccoli was studied by using 2,2´-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay. Elemental compositions were investigated by using Spectro XEPOS,EXDRF(Energy Dispersive X-ray Fluorescence) Spectrometer, Germany.

Preliminary Phytochemical test

A few grams of dried broccoli powder was subjected to the tests of alkaloids, α-amino acids, carbohydrates, flavonoids, glycosides, organic acids, phenolic compounds, polyphenol, reducing sugars, saponins, starch, tannins, steroids and terpenoids according to the standard procedure (Harborne,1984; M-Tin Wa, 1970;Robinson.,1983;Trease and Evans,1980; Vogel, 1966; Marini-Bettolo,1981).

Determination of Nutritional Values by AOAC method

The moisture content was determined by the oven drying method. The nitrogen content was determined by Kjeldahl digestion method and protein content was calculated by multiplying percent nitrogen by the factor 6.25. The fat content was determined by Soxhlet extraction method using petroleum ether (b.p 60-80˚C) run for 8h. The ash content was determined by placing sample in pre-weighed crucible and placed in muffle furnace at 500˚C for 6h. Carbohydrate percentage was determined by calculation method (AOAC,2000; Anderson, 1984; Joslyn,1973; Mark and Stewart, 1975; Pearson,1981).

Blanching Method

About 100g ofbroccoli samplewas washed in tap water to remove the adhering mud particles, drained well and rinsed with distilled water. Then, this sample was blanched for 1 min at 100˚C in water. The sample solution was then made up to 100mL in a volumetric flask.

Determination of Ascorbic Acid content

The ascorbic acidcontent was determined by iodometric titration method.According to iodometric titration method (before and after blanching),each of the standard ascorbic acid solution and fresh juice sample solution (10 mL) was pipetted into each conical flask. Then, 3 drops of 1% starch indicator solution was added to each conical flask and then titrated with iodine solution. The end point of the titration was identified as the first permanent trace of a dark blue black color due to the formation of starch-iodine complex. The final volume of iodinesolution was recorded. Titration was repeated with three times.

Determination of antioxidant Activity by DPPH Free RadicalScavenging Assay

The DPPH radical scavenging method was used to evaluate the antioxidant property. Theantioxidant activity was compared with that of the natural antioxidant,ascorbic acid. The concentration of the plant extract required to scavenge activity of each sample. 1.5 mL of 0.002% DPPH solution was mixed with 1.5mL of various concentrations (6.25, 12.5, 25, 50, 100, 200) μg/mL of sample extract. The solution without any extracts and was used as control. The mixture was shaken for 30 min. After 30 min, the reduction of the DPPH free radical was measured by reading the absorbance at 517 nm by a UV-visible spectrophotometer.

Determination of Elemental Composition

Elemental compositions of broccoli sample were examined by using EDXRF spectrometer, Germany, at Department of Physics, University ofMandalay.

Results and Discussion

The phytochemical constituents of broccoli sample were investigated by the test tube method. Alkaloids, glycosides, α-amino acids, carbohydrates,flavonoids,glycosides, phenolic compounds, polyphenol, saponins, tannins and steroids were found to be present in this sample whereas organic acids, reducing sugars, starch and trepenoids were not detected. Therefore, broccoli contains valuable phytochemical constituents for human's health.

AOAC method was used to determine nutritional values in broccoli sample. The nutritional values of moisture, fiber, ash, protein and carbohydrate were found are recorded in Table 1 and Figure 2.Broccoli is nutrients rich. Protein is essential to human health and also can be used to provide energy. Carbohydrates are major sources of food energy for men. They are needed to build and maintain muscle, blood, skin, bones, organs of the body and other tissue.Ascorbic acid content in broccoli juice was examined by using iodometric titration method. It is due to the fact that, after blanching of ascorbic acid was found to be lower than before blanching.The resultant data of before and after blanching method are recorded in Table 2.

Theantioxidant activity of ethanol extract of broccoli was studied by DPPH free radical scavenging assay. From the DPPH scavenging assay, 50% inhibition concentration (IC_{50}) value of broccoli was found to be 27.03μg/mL. The IC_{50}value for

standard ascorbic acid was found to be2.34μg/mL illustrated in Table 3, Figure 3 and 4.

The elemental composition of broccoli sample was also analyzed by EDXRF spectrometer. The results are shown in Table 4. Herbs not only provide us chemical of medicinal value but also provide us nutrition and trace elements. Minerals and trace elements are chemical elements required by our bodies for numerous biological and physiological processes that are necessary for the maintenance of health.The fact that broccoli plays important role in fighting diseases.

Table1.Nutritional Values of *Brassica oleracea* L. (Broccoli) Dried Sample

No	Parameters	Content Dried Sample
1	Moisture (%)	7.22
2	Fat (%)	3.58
3	Fiber (%)	13.90
4	Ash (%)	16.83
5	Protein (%)	18.71
6	Carbohydrate (%)	39.76

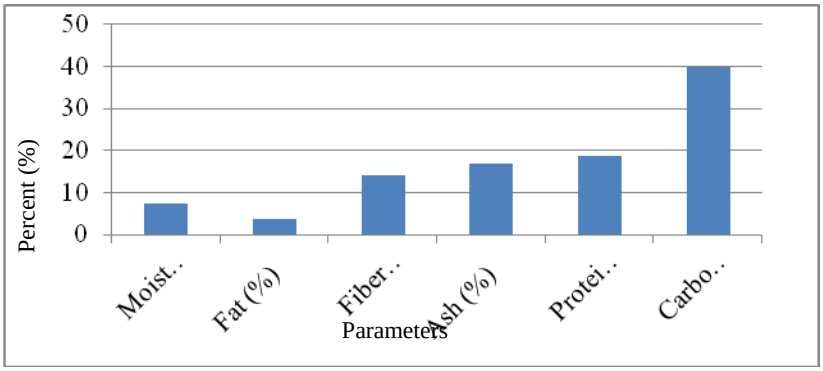

Figure 2. Histogram of nutrition values of dried broccoli sample

Table2.Comparison of Amount of Ascorbic Acid in *Brassica oleracea* L.(Broccoli)

No	Sample	Ascorbic acid(mg/100g) Before blanching	Ascorbic acid(mg/100g) After blanching
1	Broccoli	99	85

Table 3. Percent Inhibition of Different Concentrations and IC50 values of Crude Extracts from Broccoli and Standard Ascorbic Acid

Test samples	Percent inhibition in different concentrations (μg/mL)						IC_{50} (μg/mL)
	6.25	12.5	25	50	100	200	
EtOH extract (Broccoli)	10.92	12.68	14.16	15.34	17.11	18.5	27.03
Standard Ascorbic acid	42.88	46.97	52.98	59.82	68.51	76.43	2.34

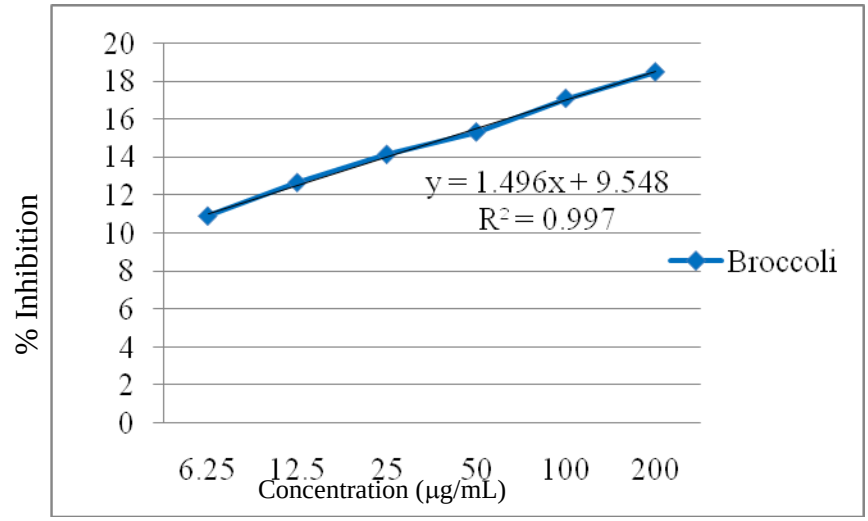

Figure 3. A plot of % inhibition vs concentration of Broccoli

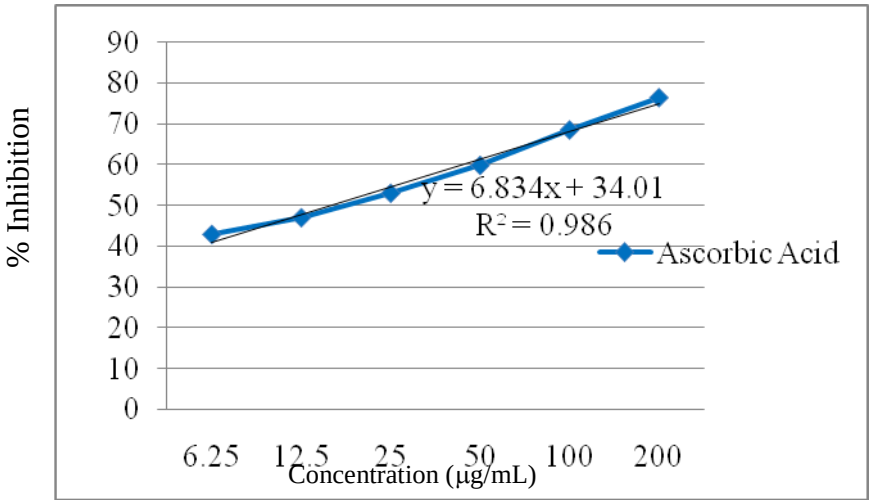

Figure 4. A plot of % inhibition vs concentration of Ascorbic Acid

Table4.Determination of Mineral Contents in*Brassica oleracea* L.(Broccoli)

No	Elements	Measuring value (%)
1	Potassium	2.6560
2	Phosphorus	0.6983
3	Calcium	0.6154
4	Chlorine	0.5412
5	Sulphur	0.2740
6	Aluminum	0.1669
7	Iron	0.0142
8	Silicon	0.0111
9	Titanium	0.0087
10	Zinc	0.0054
11	Rubidium	0.0053
12	Manganese	0.0045
13	Vanadium	0.0032

Conclusion

In the present research work, broccoli was collected for chemical analysed from Shan-lay-kyun village, AmarapuraTownship, Mandalay Region.

Firstly phytochemical screening was examined. The test tube method showed the presence of alkaloids, glycosides, α-amino acids, carbohydrates,flavonoids,glycosides, phenolic compounds, polyphenol, saponins, tannins and steroids were found to be present in this sample whereas organic acids, reducing sugars, starch and terpenodis were not detected in this sample.

Nutritional values of broccoli sample by AOAC method were found to be percentage of moisture, fat, fiber, ash, protein and carbohydrate: 7.22, 3.58, 13.90, 16.83, 18.71 and 39.76. These data are also based on dried sample.Moreover,the ascorbic acid content in broccoli sample was also determined by the use of iodiometric titration. It was found that 99mg/100g of ascorbic acid contain in broccoli.Then, this sample was blanched for 1min at 100˚C in water. The ascorbic acid contents were also determined by using iodometric titration. The result of the ascorbic acidretention in the broccolisample was found to be 85mg/100g.

The antioxidant activity of ethanol extract of broccoli was studied by DPPH free radical scavenging assay. From the DPPH scavenging assay, 50% inhibition concentration (IC_{50}) of broccoli was found to be 27.03μg/mL. The IC_{50} for standard ascorbic acid was found to be2.34μg/mL.Therefore, it can be known that broccoli sample has a good source of natural antioxidant activity

According to the results of EDXRF, the broccoli samplecontains the highest amount of potassium (2.6560%). The significant amount of phosphorus (0.6983%),calcium (0.6154%),chlorine (0.5412%) and sulfur (0.2740%) in thissample. Herbs, although, provide us nutrition and trace elements.

The findings of the present study suggest thatbroccoli is important source of protective foods, which is highly beneficial for the maintenance of good health and prevention of diseases.

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