Determination of Some Nutritional Values, Antioxidant Activity and Elemental Compositions of *Terminalia catappa*L. (Banda) Seeds

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Abstract

The study was carried out to evaluate the phytochemical, antioxidant, nutritional composition and elemental content of *Terminalia catappa* L. (almond seeds) collected from Chan Aye Tharzan Township, Mandalay District. Firstly, the phytochemical screening of seeds of banda was done. The seed of banda contains tannins, flavonoid, phenolic, alkaloid, saponin and reducing sugar. The nutrient compositions such as moisture, ash, carbohydrate, protein and fat were determined by using Association of Official Analytical Chemist (AOAC) techniques. The antioxidant activity of the ethanol extract was measured in terms of hydrogen donating or radical-scavenging ability using the stable free radical 1, 1-diphenyl-2-picryl-hdrazyl (DPPH). Minerals were determined by Energy Dispersive X-ray Fluorescence Spectroscopy (EDXRF) method. The results from observation studies showed that almond seeds have rich of protein, potassium and has antioxidant activity.

Keywords : Almond, Nutrients, Antioxidant, phytochemicals EDXRF

Introduction

All human beings require sufficient food for their growth and development and to lead an active and healthy life and it depends upon the quality and quantity of foodstuffs included in their regular diet. The quality of a food depends upon the presence of relative concentrations of various nutrients such as proteins, fat, carbohydrates, vitamins and minerals. Carbohydrates, fat and proteins are sometimes referred to as proximate principles and form the major portion of the diet while minerals play an important role in the regulation of the metabolic activity in the body. It has been established that antioxidants found in large quantities in the crude extracts of fruits, herbs, vegetables, cereals and other plant materials act as reducing agents and thereby improve the quality and nutritional value of the food. The importance of the antioxidant constituents of plant materials has also been established in the maintenance of health by acting against stress related diseases such as infections, diabetes, cancer and coronary heart disease.

Almonds come in two varieties, sweet and bitter. Sweet almonds are used in many Asian dishes, as well as dessert pastes and garnishes. A popular use for crushed sweet almonds is a European candy base called marzipan. Sweet almonds can also be processed into essential oils or extracts and almonds are high in healthy monounsaturated fats, fiber, protein and various important nutrients. The almond is a very popular tree nut and a very good source of vitamin E, manganese, biotin, copper, riboflavin (vitamin B_2), and phosphorus.

Aim and objectives

Aim

The aim of this research work is to determine the minerals, nutritional values and antioxidant activity of almond (*Terminalia catappa* L.) seeds.

Objectives:

- To collect almond seeds from Chan Aye Tharzan Township, Mandalay Distric
- To determine phytochemical properties of almond seeds

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- To determine the nutritional values of almond seeds (moisture, ash, carbohydrate, protein and fat content)
- To determine the antioxidant activity of almond seeds
- To determine elemental analysi

Botanical description of almond


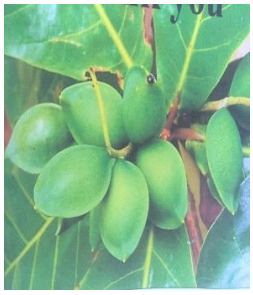

Figure 1. Almond tree, fruit and seeds

Botanical name	-	*Terminalia catappa* L.
English name	-	Almond
Myanmar name	-	Badan
Family	-	Combretaceae
Part used	-	Seeds

Material and Methods

Sample collection

Almond seeds were collected from Chan Aye Tharzan Township, Mandalay District. They were cut into small pieces and dried in air. They were stored in well stoppered bottle which were used throughout the experiment.

Preliminary phytochemical test of almond seed

The phytochemical studies of the almond seed have been tested according the standard procedure. Some of chemical compounds such as tannin, flavonoid, phenolic, alkaloid, spanning and reducing sugar were found in this almond seed

Determination of some nutritional values of *Terminalia catappa* L.

The ash content, moisture content, carbohydrate content, fat content and protein content were determined by respective methods.

Investigation of antioxidant activity of almond seed

The DPPH radical scavenging activity of ethanol extracts from seed of almond was compared with ascorbic acid. DPPH radical scavenging test is based on the exchange of hydrogen atoms between the antioxidant and the stable DPPH free radical. The reduction capability of DPPH radicals was determined by the decrease in its absorbance at 517 nm, which is induced by antioxidants. The significant decrease in the concentration of the DPPH radical is due to the scavenging ability of ethanolic extract of seed of almond. Determination of radical scavenging by DPPH method is based on the change in absorbance of crude extracts solutions in various concentrations. Six kinds of concentrations 2μg/mL, 1 μg/mL, 0.5 μg/ mL, 0.25μg/ mL, 0.125μg/ mL and 0.0625μg/mL were prepared by dilution with ethanol as solvent. Ascorbic acid was used as standard sample and ethanol was employed as control. These values are used to calculate the percentage inhibition of DPPH radical against the samples. The IC_{50} values of various extracts were calculated from the

percentage inhibition at various concentrations. The results of the free radical scavenging activity of seed of were assessed by DPPH assay that was summarized by IC_{50} using method of linear regression.

Analysis of semi quantitative elements

The semi- quantitative elemental analysis of *Terminalia catappa* L. (almond seed) was performed by EDXRF method.

Results and Discussion

The phytochemical tests revealed that tannin, flavonoid, phenolic compound, alkaloid, saponin and reducing sugar were present in the sample. The observed phytochemical constituents are essential compounds for the metabolism and nutrition of human body.

The nutritional compositions of almond seeds (ash, moisture, carbohydrate, protein and fat contents) were determined and the results were shown in Table 1.

The results of the free radical scavenging activity of seed of almond were assessed by DPPH assay that was summarized by IC_{50} using method of linear regression. The lower the value of IC_{50} the higher is the antioxidant property. It was observed that the ascorbic acid and ethanol extract of seed of almond have been illustrated in Table 2 and 3.

The elemental compositions of almond seed sample by EDXRF method results were tabulated in Table 4.

Table 1. Nutritional compositions of almond seeds

No.	Content	Analytical Method	Value
1.	Ash	Loss of weight in ignition	4.11 %
2.	Moisture	Gravimetric method	4.52 %
3.	Carbohydrate	Phenolsulphuric acid Colourimetric method	4.80
4.	Protein	Kjeldahl method	25.01
5.	Fat	Petroleum Ether Extraction method	49.72

From the determination of almond seeds, it was found that the amount of fat content was highest in the sample.

Table 2. Absorbance, DPPH % radical scavenging of various concentration and IC_{50} value of ascorbic acid

Tested Sample	Concentration (µg / mL)	Absorbance (517 nm)	DPPH % Radical Scavenging	IC_{50} (µg /mL)
Ascorbic acid	0.0625	1.9969	44.3078	0.031
	0.125	1.7828	50.2761	
	0.25	1.6269	54.6268	
	0.5	1.4826	58.6513	
	1	1.2721	64.5220	
	2	1.1242	68.6468	

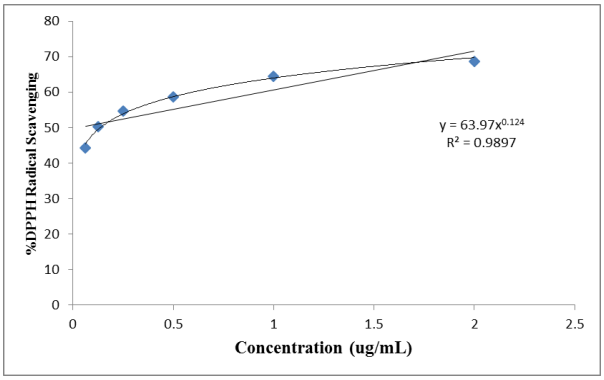

Figure 2. The plot of DPPH % radical scavenging Vs concentration (µg/mL) of ascorbic acid

Table 3. Absorbance, DPPH % radical scavenging of various concentration and IC_{50} value of EtOH extract of almond seeds

Tested Sample	Concentration (µg / mL)	Absorbance (517 nm)	DPPH % Radical Scavenging	IC_{50} (µg /mL)
Almond seed	31.25	2.0259	43.5000	35.782
	62.5	1.7982	50.0200	
	125	1.6440	54.1536	
	250	1.3653	61.9227	
	500	1.2756	64.4244	
	1000	0.9252	74.1968	

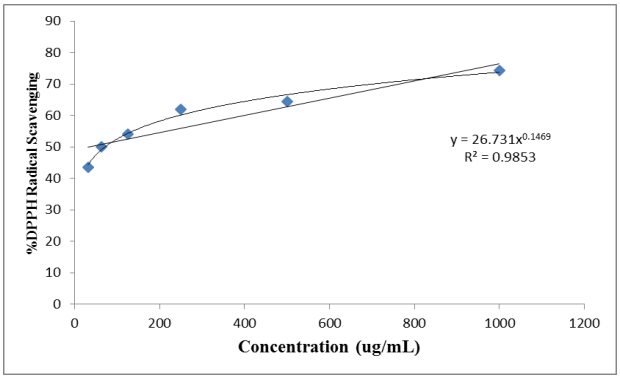

Figure 3. The plot of DPPH % radical scavenging Vs concentration (µg/mL) of EtOH extract of almond seeds

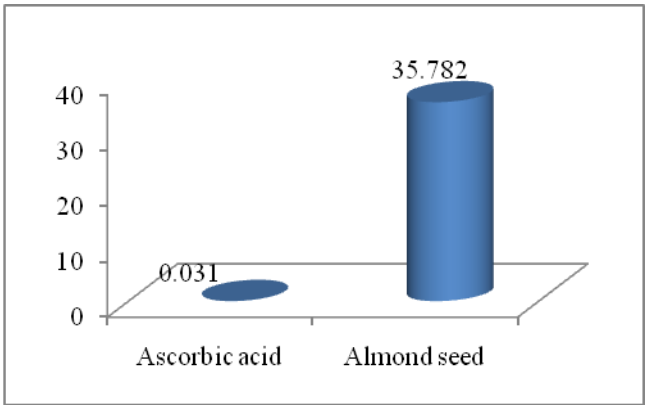

Figure 4. IC_{50} value of almond seeds with ascorbic acid

According to the results of antioxidant screening, the IC_{50} value of ethanolic extract was found to be 35.782 µg/mL. IC_{50} value is inversely related to the free radical scavenging activity. As the almond seed possesses the rich antioxidant properties, it may be consumed for the human health.

Elemental Compositions of Almond Seed by EDXRF Method

Elemental compositions of almond seeds samples by EDXRF method results were tabulated in Table (4).

Table 4. The results of mineral compositions of almond seeds

No	Name of Element	Symbol	Result (%)
1	Potassium	K	0.8907
2	Phosphorus	P	0.7810
3	Calcium	Ca	0.5460
4	Magnesium	Mg	0.3420
5	Sulphur	S	0.2310
6	Chlorine	Cl	0.0743
7	Iron	Fe	0.0089
8	Zinc	Zn	0.0079
9	Manganese	Mn	0.0030
10	Cupper	Cu	0.0028
11	Strontium	Sr	0.0010

According to EDXRF method results, the high content of potassium is effective for the persons with hypertension. Calcium helps the teeth and bones to be strong for human.

Conclusions

The almond seeds were determined the phytochemical properties, antioxidant activity, nutritional values and mineral contents. The values of ash and moisture content were 4.11 % and 4.52 % respectively. Carbohydrate, protein and fat contents were 4.80 %, 25.01 % and 49.72 % respectively. In the study of elemental analysis, the high contents of potassium (0.890 %), phosphorus (0.7810 %), calcium (0.5460 %) and magnesium (0.3420 %) were observed. The high content of potassium is effective for the persons with hypertension. Calcium helps human's teeth and bones to be strong. From the determination of nutritional composition of almond seeds, it was found that the amount of fat and protein were high in the samples. The antioxidant activity of ethanol extract was also screened. IC_{50} value of ethanol extract was 35.782 µg/mL. According to the results of antioxidant screening, almond seeds possess antioxidant property. It may be used for human health.

Approximately 33 g of proteins are lost each day by the average adult male and this can be replaced with those from the diet. Also growing children need more protein than adult per unit weight since more protein is needed for growth. The results show that consumption of almond will contribute significantly on healthy benefits. The health benefits of almonds included blood pressure and sugar levels, reduced blood pressure and lower cholesterol levels. In this regard, attention should be drawn to cheap sources of protein like almond seeds proven to be edible, available and affordable, and which contain most of the nutritional requirement in large proportion.

References

A.I. Vogel, "*A Text Book of Practical Organic Chemistry*", 5th Edition, Longmans, Green & Co. Ltd, London, 1969.

AOAC, Association of Official Analytical Chemists. Official methods of analysis, Washington, D.C., 2006.

D.A.T., Southgate, "Determination of food carbohydrates", London: Applied Science Publishers, Ltd, 178p. (links), 1979.

Harbone, J.B. "Phytochemical Methods", "A Guide to Modern Techniques of Plant Analysis", USA: Chapman and Hall Ltd.

I.R., Record, I.E. Dreosti, and J., McInerney, "The antioxidant activity of genistein in vitro", J. Nutr. Biochem., 6, 481-485, 1995.

N.P., Gullett, A.R., Amin, S., Bayraktar, *et al*. "Cancer prevention with natural compounds". *Semin Oncol.* Jun; *37*(3):258-81. Review.,2010.