

Determination of Some Nutritional Values, Antimicrobial Activity and Evaluation of Total Phenolic Compound from the Red Dragon (*Hylocereus polyrhizus*) Fruit

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Abstract - In this research work, the red-fleshed pitaya or red dragon fruit, *Hylocereus polyrhizus* was selected to qualify and quantify the phenols present in it. Firstly, some nutritional values of this sample were analyzed by AOAC method. Furthermore, the antimicrobial activities of this collected sample were tested by Agar-well diffusion method on six selected organisms. In addition, the fresh juices were prepared by crushing from red dragon fruits to determine the total phenolic content. Moreover, this expressed juice was checked for qualitative tests of phenols. Finally, the phenolic content of red dragon fruit could be evaluated by the spectrophotometric method using PD 303-UV visible spectrophotometer.

Index Terms- *Hylocereus polyrhizus*, phytochemical tests, nutritional values, AOAC method, Agar-well diffusion method, phenols, spectrophotometric method.

I. INTRODUCTION

Plants are the good sources for the discovery of pharmaceutical compounds and medicines. Natural products could be potential drugs for humans or live stock species and also these products and their analogues can act as intermediates for synthesis of useful drugs [1]. Plants possess many phytochemicals with various bioactivities including, carotenoids, ascorbic acid, α -tocopherol and polyphenols [2], [3], [4]. Plants are excellent sources of food, chemicals and herbal medicines. Many important drugs have been directly or indirectly derived from them [5].

Phenolic compounds are secondary metabolites that are derivatives of the pentose phosphate, shikimate, and phenylpropanoid pathways in plants [6], [7], [8]. Phenolics are antioxidants with redox properties, which allow them to act as reducing agents, hydrogen donors, and singlet oxygen quenchers [9]. They have also metal chelation properties [10]. Recently there has been an upsurge of interest in the therapeutic potentials of medicinal plants as antioxidants in reducing such free radical induced tissue injury. Besides well known and traditionally used natural antioxidants from tea, fruits, vegetables and spices, some natural antioxidant are already exploited commercially either as antioxidant additives or a nutritional supplements [11].

Dragon fruit (*Hylocereus* spp.) is a promising tropical fruit which can be cultivated in different tropical and subtropical parts of the world such as Southeast Asia, and Central and South America. The demand for dragon fruit extensively increases and the fruit today can be found on almost all exotic fruit markets around the world [12].

Dragon fruit has interesting nutritional and functional components. Dragon fruit contains significant amounts of minerals such as potassium, phosphorus, sodium and magnesium [13], [14]. Phenolic compounds in dragon fruit consist mainly of gallic acid (GA) and ferulic acid with minor amounts of other hydroxycinnamic acids [15]. Besides phenolic acids, dragon fruit also contains some flavonoid compounds [16]. Therefore, the red dragon fruit which is phenolic rich one was selected for the detail chemical analysis.

The aim of the study was to determine the some nutritional values and antimicrobial activity, as well as total phenolic compounds from the red-fleshed pitaya or red dragon fruit, *Hylocereus polyrhizu*.

II. MATERIALS AND METHODS

2.1 Sample Collection

The fruits of *Hylocereus polyrhizus*, red dragon fruits were purchased from local market, Mandalay Region in Myanmar.

2.2 Determination of Nutritional Values and Physico-chemical Characterization of Red Dragon Fruits

Nutritional values of fruit of *Hylocereus polyrhizus* were measured at Food Industries Development Supporting Laboratory (FIDSL), Yangon, Myanmar by AOAC (Association of Official Analytical Chemists) method [17].

2.3 Antimicrobial Activities of Red Dragon Fruits

Antimicrobial activities of red dragon by using n-hexane, ethyl acetate and ethanol were investigated against *Bacillus subtilis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Bacillus pumilus*, *Candida albicans* and *Escherichia coli* species of

microorganisms by employing Agar well diffusion method at PFRD (Pharmaceutical Food Research Department), Insein, Yangon [18].

2.4 Preparation of Red-fleshed Fruit Juice Solution of *Hylocereus polyrhizus*

100 g of red-fleshed dragon fruit were crushed with 175 mL of distilled water by blender. These juices were squeezed, filtered and then centrifuged with 5000 rpm for 30 minutes. 215 mL of expressed juice which is the liquid product was obtained for the determination of total phenolic content in this sample.

2.5 Qualitative Test for Phenols

Group Test

The fresh juice of dragon fruit was tested by blue litmus paper. This blue litmus paper turns red.

Colour with $FeCl_3$

1 mL of fresh juice of dragon fruit was taken and a few drops of very dilute solution of ferric chloride were added. The colour changes to brown which indicates the presence of phenol [19].

2.6 Quantitative Determination of Total Phenolic Content

The amount of total phenol in extract was determined according to the Folin-Ciocalteu procedure [20].

2.6.1 Principle

Phenols in alkaline medium react with phosphomolybdic acid of Folin-Ciocalteu reagent producing a blue coloured complex.

2.6.2 Preparation of Standard Gallic Acid Stock Solution

10 mg of the standard gallic acid was taken in a test tube. 10 mL of distilled water was added to the standard compound. 1 mL of this standard solution was taken in another test tube. The volume of this solution was made up to 10 mL with distilled water.

2.6.3 Estimation of λ_{max} for Gallic Acid

To determine the absorption maximum, standard solution of gallic acid in concentration 7.5 $\mu\text{g/mL}$ was prepared. And then, 100 μL of Folin-Ciocalteu reagent and 300 μL of saturated Na_2CO_3 (20%) solution were added. After this standard solution was heated in the water bath at 40°C for 30 minutes and then cooled at room temperature. The spectrum of this solution was measured in the wavelength interval 700 to 800 nm.

2.6.4 Determination of Standard Gallic Acid

The standard gallic acid stock solution was taken by micropipette into a series of test tubes 20 μL , 40 μL , 60 μL , 80 μL and 100 μL respectively. The volume was made up to 1.6 mL with distilled water in each test tube. And then, 100 μL of Folin-Ciocalteu reagent and 300 μL of saturated Na_2CO_3 (20%) solution were added. After the each standard solution was heated

in the water bath at 40°C for 30 minutes and then cooled at room temperature. The absorbances of prepared standard gallic acid solutions were measured by PD-303 UV visible spectrophotometer at 765 nm with respect to the blank solution. The assay was carried out in triplicate.



Figure 1: Prepared standard solutions of gallic acid with different concentration

2.6.5 Determination of Total Phenolic Content of *Hylocereus polyrhizus* (Red Dragon Fruit)

The total phenolic content of expressed red dragon juice was measured with the Folin-Ciocalteu reagent. Firstly, 40 μL of expressed juice was taken in a test tube. It was made up to 1.6 mL with distilled water. 100 μL of Folin-Ciocalteu reagent was mixed, then 300 μL of saturated Na_2CO_3 (20%) was added. The mixture was heated in a water bath at 40°C for 30 minutes and then cooled at room temperature. The absorbance of this prepared sample was measured at 765 nm by using UV-spectrophotometer. The assay was carried out in triplicate. The total phenolic content of red dragon fresh juice was expressed as mg gallic acid equivalent (GAE) / 100 g FW.



Figure 2: Prepared solution of expressed red dragon fresh juice

III. RESULTS AND DISCUSSION

In this section, the results obtained from the experimental works such as some nutritional values, antimicrobial activity and spectrophotometric determination of total phenolic content in red dragon fruit were discussed.

Some Nutritional Values of *Hylocereus polyrhizus* (Red Dragon Fruit)

Some nutritional compositions of red dragon fruit such as water content, ash, crude protein, crude fiber and crude fat were determined by AOAC method and observed data are listed in Table 1.

Table 1: Results of nutritional values of the red dragon fruit

No	Parameters	Observed data
1.	Water content	86.71 %
2.	Ash	0.52 %
3.	Crude Protein	0.94 %
4.	Crude Fiber	1.14 %
5.	Crude Fat	0.22 %

According to this table, the results obtained in nutritional values are water content 86.71%, ash 0.52%, protein 0.94%, crude fiber 1.14% and crude fat 0.22% in red dragon fruit. All of the resulting data were obtained by triplicate measurements. Mean value was described for each.

Antimicrobial Activities of Red Dragon Fruits

The antimicrobial activities of red dragon fruit were determined by Agar well diffusion method on six tested organisms. The results are tabulated in Figure 3.

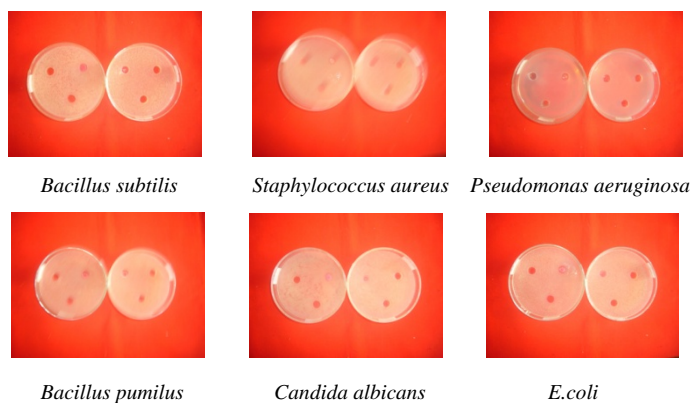


Figure 3: Antimicrobial activities of various solvent extracts of red dragon fruit

In accordance with these results, the ethyl acetate extract of this selected sample gave medium activities on *E-coli* and low activities on remaining five organisms. The ethanol extract of this selected sample gave low activities on six tested organisms. Moreover, n-hexane extract of red dragon fruit responds low activities on *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Candida albicans* and *E-coli*.

Special Test for Phenol

The fresh juice obtained by crushing from the red dragon fruit was examined by using the special qualitative tests of phenol. The resulted data are tabulated in table 2.

Table 2: Special test for phenol

No	Experiment	Observation	Inference
1.	Group Test	Blue litmus paper turns red	Phenol may be present.
2.	Color with FeCl ₃	Brown color was observed	Phenol is present.

From these results, it was observed that the fresh juice of the selected sample consists of phenolic compounds.

Total Phenolic Content in Red Dragon Fruit

Determination of total phenolic content was carried out by Folin-Ciocalteu reagent method using spectrophotometer.

Absorption Maximum Wavelength of Gallic Acid

Scanning of the complex in a wavelength range from 700 nm to 800 nm showed a maximum absorbance (λ_{max}) at 765 nm as shown in Figure 4.

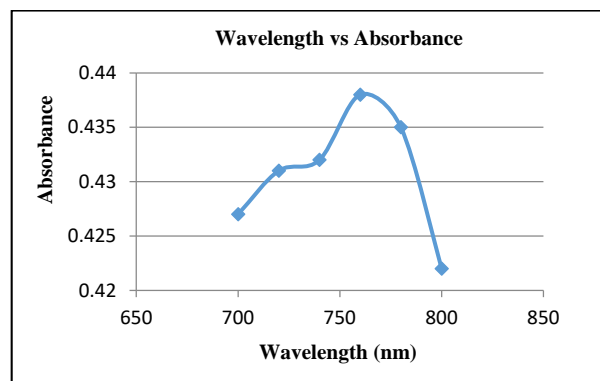


Figure 4: Maximum wavelength of standard gallic acid

Standard Gallic Acid

The standard gallic acid solutions at concentration 2 to 10 $\mu\text{g/mL}$ in distilled water were measured to know their absorbance by PD-303 UV visible spectrophotometer. The calibration curve was plotted against by using the resulting data of standard gallic acid solution as shown in figure 5.

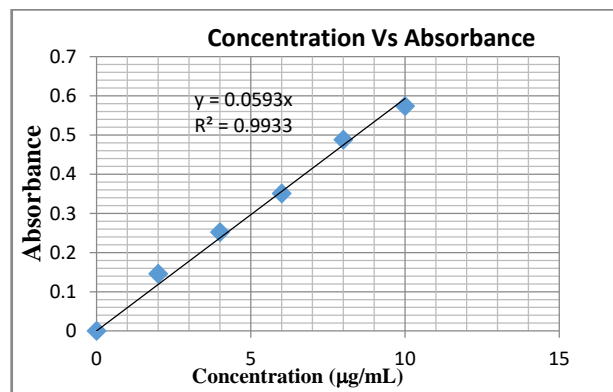


Figure 5: Concentration and absorbance calibration curve for standard gallic acid

Evaluation of Total Phenolic Content in Red Dragon Fruit

The total phenolic content of the fresh juice was carried out by spectrophotometric method using the Folin-Ciocalteu reagent. The absorbances of prepared sample solutions (40 μ L with 1.56 mL distilled water) were measured with UV spectrophotometer at 765 nm with respect to the blank solution for three times. The results are described in table 3. From these results, the amount of total phenolic content of analyzed sample was obtained by using the standard curve.

Table 3: Amount of phenolic content in red dragon fruit

No	Name of Sample	Phenol (mg/100 g)	Phenol (mg/100 g) Mean \pm Standard Deviation
1.	Red dragon	37.46	38.27 \pm 0.7
		38.81	
		38.54	

In accordance with these results, the content of total phenolic compounds of red dragon fruit was found to be 38.27 \pm 0.7 mg gallic acid equivalent (GAE) per 100 g fresh weight (FW).

IV. CONCLUSION

In this research work, one of the most commonly consumed fruits by the Myanmar population, the red dragon fruit, *Hylocereus polyrhizus* was selected for qualitative and quantitative determination of phenolic content. The nutritional values and antimicrobial activity could be detected. In accordance with the qualitative test of phenol, it was confirmed that this fresh juice contains the phenolic compounds. Moreover, the total phenolic content of fresh juice obtained from the selected sample was found to be 38.27 \pm 0.7 mg gallic acid equivalent (GAE) per 100 g FW. The results of the current investigation showed that the analyzed sample, the fruit of red dragon had the significant amount of total phenolic compounds. Phenolic compounds are secondary metabolites and plant phenolic compounds are a major group of compounds that act as primary antioxidants or free radical scavengers. Since these compounds were found to be present in the extracts, it might be responsible for the potent antioxidant capacity of red dragon fruit.

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