

EVALUATION OF FUNCTIONAL PROPERTIES OF *HYLOCEREUS UNDATUS* (WHITE DRAGON FRUIT)

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ABSTRACT

The present study was carried out to evaluate the phytochemical analysis, in vitro antioxidant, antidiabetic, antilipase and antimicrobial activity of the Hylocereus undatus juice extract. The antioxidant activity of the fruit extract was determined in vitro using the DPPH method. In vitro antidiabetic activity of fruit extract was observed by starch-agar gel diffusion method. The Antilipase activity of the aqueous fruit extract was assessed by the Rhodamine agar plate method. The results of the present study conclude that Hylocereus undatus juice extract possesses antioxidant, antidiabetic and antilipase activities. Phytochemical screening of the white dragon fruit showed the presence of triterpenoid, alkaloid, flavonoid and saponin.

KEYWORDS: Antioxidant, Antidiabetic, Antilipase, Dragon Fruit

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INTRODUCTION

Dragon fruit or pitaya is one of the tropical fruits under the cactus family, *Cactaceae*. There are three main types of dragon fruit species available for commercial cultivation, namely, *Hylocereus undatus* (white flesh with pink skin), *Hylocereus polyrhizus* (red flesh with pink skin) and *Selenicereus megalanthus* (white flesh with yellow skin). *H. undatus*, or commonly known as white pitaya owing to its white flesh (Lim *et al.*, 2012 and Bellec *et al.*, 2006). *H. undatus* originates from southern part of Mexico and it is now widely introduced in Asia countries such as Taiwan, Malaysia and Vietnam as well as northern Australia (Lim *et al.*, 2012). The pitaya flesh contains small black seeds scattered in white-flesh (Barbeau, 1990) and the raw flesh is mildly sweet and low in calories (Zainoldin and Baba, 2009).

Dragon fruit is a popular commercial fruit, which can be eaten fresh and used for culinary and confectionery purposes. It can also be fermented as wine and for the extraction of functional enzymes. The fruit is mostly consumed fresh; however, the frozen pulp may be used to make yogurt, candies, ice cream, marmalade, jelly, juice and pastries. Unopened flower buds can be used as a vegetable. The mild laxative activity of dragon fruit is due to its seeds, which contain oil (Cheah and Zulkarnain, 2008; Crane and Balerdi, 2005). Its products have several useful properties, including as coloring agents, thickening properties, high antioxidant capacity and dietary fibre (Bellec *et al.*, 2006).

Extensive researches have been conducted on the properties of red pitaya pigment and the antioxidant properties of flesh and peel of red pitaya. White dragon fruit is a type of cactus plants that still do not have complete reference information, both in terms of phytochemical and pharmacology in order to be optimally used as a form of alternative medicine. Utilization of these plants as traditional medicine is based on empirical evidence so

there is a need to find a scientific basis about utilities and types of bioactive compounds in dragon fruit with the use of research approaches to biochemistry and modern biology.

The objectives of the present study are phytochemical screening, antioxidant, antidiabetic and antilipase activity of aqueous extract of white dragon fruit. The present study aimed to promote the contribution of white dragon fruit in public health campaigns to encourage the daily consumption of white dragon fruit, through phytochemical screening and evaluation of functional properties.

MATERIALS AND METHODS

The media, reagent, chemicals and solvents used in this study were obtained from Hi Media, Mumbai, India. The fresh fruits of *Hylocereus undatus* were procured from Koyambedu market, Chennai.

Preparation of Fruit Extract

The fruits were thoroughly washed first with tap water and then distilled water separately. The whole fruits were pureed well using a juicer and then filtered through a sterilized mesh cloth to separate the aqueous fraction of fruit of particles. The juice was then kept in a tight container and was stored in -20°C before further analysis.

Phytochemical Screening

Five millilitre of fruit extract was taken in 250 ml conical flasks and added 50 ml of distilled water, acetone, ethyl acetate, methanol and ethanol each at a proportion of 1:10. The flasks were stoppered tightly and kept in a refrigerator for 48 hrs. The content of the flasks was shaken intermittently during the maceration period. After 48 hrs the contents in the flasks were filtered through Whatmann filter paper No.1. The final filtrate was transferred to the sterilized container and was subjected to a series of chemical tests to detect the presence and/or absence of various active principles viz. Alkaloids, proteins, reducing sugars, tannins, sterols, phenolic compounds, flavonoids, triterpenoids and saponins (Trease and Evans, 2002; Harborne, 1998 and Sofowora, 1993).

Estimation of Antioxidant Activity

The total antioxidant activity of fruit extract was determined as per the DPPH (1,1-diphenyl-2-picrylhydrazyl) method adopted by Brand-Williams *et al.*, (1995). The DPPH radical scavenging activity was estimated by measuring the decrease in the absorbance of the methanolic solution of DPPH. Different volumes of fruit (50-200 μl) extract were allowed to react with the DPPH solution (3.3 mg of DPPH in 100 ml methanol), incubated for 30 minutes in the dark and the absorbance (A_1) was read at 517 nm. The absorbance (A_0) of a reaction control (methanol instead of fruit extract) was also recorded at the same wavelength. Ascorbic acid (5-50 $\mu\text{g/ml}$) was used as a standard. Scavenging ability (%) was calculated by using the formula:

$$\text{DPPH radical scavenging activity (\%)} = \frac{[A_0 - A_1]}{A_0} \times 100$$

Where, A_0 was the absorbance of reaction control and A_1 was the absorbance of fruit extracts or standards.

Determination of α -Amylase Inhibition Activity

For screening of α -amylase inhibition activity, the method developed by Fossum and Whitaker (1974). A starch substrate media containing 5 g agar and 5 g starch in 500 ml distilled water was prepared, autoclaved and poured in petri plates. For determination of α -amylase inhibition activity wells of 10 mm in diameter were made in the starch agar gel with cork borer. A fixed volume (10 μ l) of enzyme and different volume of fruit extract (25-100 μ l) were added into the wells. The plates were allowed to incubate for 24 hours at 37 (C. At the end of incubation, the starch agar plate was flooded with Gram's iodine solution and excess solution poured off. The presence of inhibitory activity was indicated by blue colour around the wells because of non-hydrolysis of starch. It was compared with control, containing α -amylase (10 μ l) solution. The presence of α - amylase activity was indicated by a clear zone around the well because of hydrolysis of starch.

$$\text{Amylase inhibition (\%)} = \frac{\text{Dia. of zone of Control (mm)} - \text{Dia. of zone of fruit extract (mm)}}{\text{Diameter of zone of Control (mm)}} \times 100$$

Determination of Anti Lipase Activity

The lipase inhibition activity was assayed using a Rhodamine agar plate assay according to the method of Kouker and Jaeger (1987). Rhodamine B- Olive oil Agar medium containing Olive oil 3 % (v/v), Agar 2 % (w/v), Rhodamine B 1 % (v/v), Tris-HCl buffer (pH 7), 50 mM CaCl₂ 1 % was used for the study. Rhodamine agar medium was prepared in distilled water, autoclaved, and cooled to 60 °C. The cooled medium was added with 3 % of olive oil previously sterilized at 160°C for 2 h in hot air oven and 1 % filter sterilized Rhodamine B (1 mg/ml). The contents were mixed well to dissolve and the medium was poured into petri dishes. Circular wells of 10 mm were punched in the agar plates and 10 μ l of the commercially available lipase enzyme solution and different levels of fruit extract was dispensed into each well. The plates were allowed to incubate for 48 hours at 37°C. The hydrolysis of substrate cause the formation of orange fluorescent halos around the wall visible upon UV irradiation. The rate of inhibition was calculated by the following formula:

$$\% \text{ of inhibition} = \frac{\text{Dia. of zone of Control (mm)} - \text{Dia. of zone of fruit extract (mm)}}{\text{Diameter of zone of Control (mm)}} \times 100$$

Statistical Analysis

The data obtained were analyzed statistically using the Software of Statistical Package for Social Sciences (SPSS 16.0) and as per the standard procedure adopted by Snedecor and Cochran (1994).

RESULTS AND DISCUSSIONS

The present study was carried out to determine phytochemicals, antioxidant, antidiabetic and antilipase activity of aqueous extract of white dragon fruit. The results of qualitative tests for detection of phytochemicals present in the different solvent extract of the fruit are shown in Table 1. The qualitative tests were carried to find out the presence of active principles *viz.* Phenols, alkaloids, terpenoids, saponin, flavonoids, steroids, tannins, carbohydrates, proteins, amino acids and carotenoid compounds with different solvent extracts of dragon fruit.

Table 1: Phytochemical Analysis of Aqueous Extract of Dragon Fruit @

Parameters	Dragon fruit				
	Aqueous	Acetone	Ethanol	Methanol	Ethyl acetate
Phenols	+	+	+	+	+
Terpenoids	+	+	+	+	+
Tannins	-	-	+	+	-
Saponins	+	+	+	+	+
Flavonoids	+	+	+	+	+
Steroids	-	+	+	+	+
Alkaloids	+	+	+	+	+
	+	+	+	+	+
	+	+	+	+	+
Carbohydrate	+	+	+	+	+
	+	+	-	-	+
	+	+	+	+	+
Proteins	+	+	+	+	+
Amino acids	+	+	+	+	+

@- Average of six trials

+ Present, - Absent

From table 1, it was observed that the chemical constituents viz., saponins, phenols, terpenoids, flavonoids, carbohydrate, proteins, amino acids and alkaloids were found in all the solvent extracts of dragon fruit. These results were in accordance with the findings of Susanti *et al.* (2012) as they reported that the white dragon fruit showed the presence of triterpenoid, alkaloid, flavonoid and saponin.

Antioxidant Activity of Dragon Fruits

Figure 1 shows the antioxidant activity of aqueous extracts of dragon fruit. From the data presented in the table, it was found that the functional properties of different concentrations of fruit samples differ highly ($P < 0.01$) significant. The antioxidant activity exhibited by fruits was dose dependent. The antioxidant activity increased as the concentration increased. The antioxidant activity of dragon fruit was observed by spectrophotometer using the DPPH method in the range of 18.500 to 30.000 per cent.

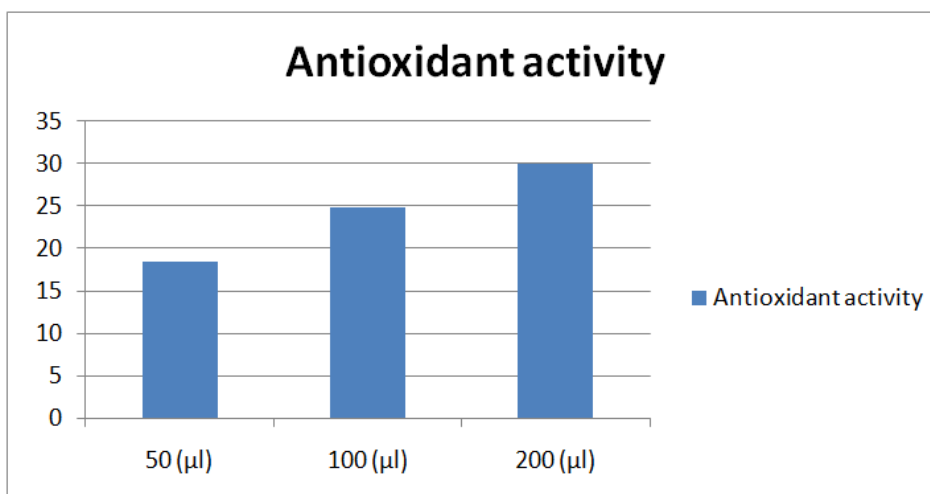


Figure 1: Antioxidant Activity of Dragon Fruit

These results were in accordance with the study of Kim *et al.* (2011) and Mahattanatawee *et al.* (2006) in which dragon fruit showed higher antioxidant activity in the DPPH radical scavenging assay. Betacyanins in dragon fruit were exhibited the highest antioxidant activities in DPPH assay and its activity was almost 10 times higher in peels than in the flesh of dragon fruit (Kanner *et al.* 2001). The present study was in agreement with the results of Susanti *et al.* (2012) who reported that the white dragon fruit is rich in flavonoids and exhibit strong antioxidant activity in the DPPH methods. The antioxidant activities well correlated to flavanoid content of flavonoid compounds.

Antidiabetic and Antilipase Activity of Dragon Fruit

Figure 2 shows the antidiabetic and the antilipase activity of aqueous extracts of dragon fruit. From the data presented in the table, it was found that the functional properties of different concentrations of fruit samples differ highly ($P < 0.01$) significant. The antidiabetic activity of dragon fruit extracts was in the range of 1.033 to 32.436 percent at different concentrations. The antilipase activity of dragon fruit extracts was in the range of 6.125 to 46.938 percent at different concentrations. The functional properties of the dragon fruit extract increased as the concentration increased.

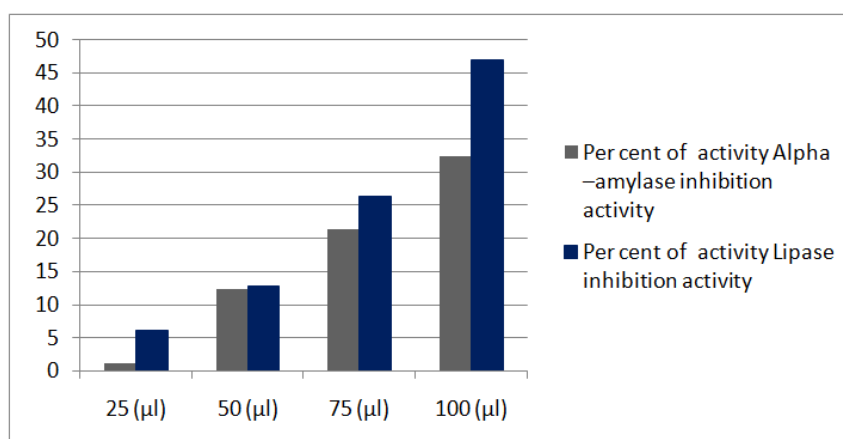


Figure 2: Antidiabetic and Antilipase Activity of Dragon Fruit

The antidiabetic effect of red pitaya has also recently been demonstrated by AbdHadi *et al.*, (2012). They suggested that red pitaya significantly improved insulin resistance and 600 g amount of red pitaya fruit consumption every day decreased the blood glucose level in type II diabetics (Omidzadeh *et al.*, 2014; AbdHadi *et al.*, 2012 & Yusof and Akhiruddin 2009). Dragon fruit is helpful in reducing blood sugar levels in people suffering from Type-2 diabetes and studies suggested that the glucose found in dragon fruit helps in controlling the blood sugar level for diabetes patients (Wee *et al.*, 2011).

CONCLUSIONS

Pitaya is a promising source of alternative medicine that might serve as an antioxidant, antidiabetic and antilipase agents. However, further studies on identification, purification and quantification of bioactive compounds from pitaya are necessary; and determination of its mechanism of action should be conducted to gain a better view on the fruit's medicinal properties. Thus, further works on this fruit would provide more information on the benefits of consuming pitaya.

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