Assessment Of Nutritive Value Of Dragon Fruit (*Hylocereus Polyrhizus*)

Md. Shariful Islam *[1], Prince Biswas [1], Md. Maksudul Haque [2], Elora parvin[1], Md. Musfikus salehin[1], Mursaleen Zebin Turin[1], Sonia Sarmin [1]

[1] Scientific Officer, Bangladesh Institute of Research and Training on Applied Nutrition (BIRTAN)
[2] Senior Scientific Officer, Bangladesh Institute of Research and Training on Applied Nutrition (BIRTAN)

***Corresponding Author: rsharifulislam4972@gmail.com**

DOI: 10.29322/IJSRP.13.03.2023.p13530
http://dx.doi.org/10.29322/IJSRP.13.03.2023.p13530

Paper Received Date: 15th February 2023
Paper Acceptance Date: 15th March 2023
Paper Publication Date: 24th March 2023

Abstract- The research was explained the nutritive value of 3 different varieties of Dragon fruit (*Hylocereus polyrhizus*) namely BAU1, BAU2 & BARI1. The main purpose of the research was to determine the nutrient content and to compare nutritional quality among the all varieties & help to know the amount of actual nutrition content of all varieties. The nutritional value is effective for human health. Nutritive value is based on the physical & chemical properties of fruit such as moisture, ash, fat, carbohydrate, protein, energy, Vitamin-C, K, Mg, Fe, Ca, phenolic content, IC50, flavonoid, & fiber content. Dragon Fruits are rich source of antioxidants. All dragon fruit varieties I found sufficient amount of antioxidant activity. Among the 3 fruit varieties the BARI1 showed the maximum amount of carbohydrate (22g), sugar (13g), energy (10kcal), Vitamin-C (5.6mg), Mg (72mg), phenolic content (326mg), IC50 (1200.95 ppm), antioxidant activity (81%), Flavonoid content (210mg). On the other hand, BAU1 showed maximum amount of moisture (89%), protein (2g), K (275mg) & fiber (5gm) but minimum amount of ash (0.8%), carbohydrate (11.5g), sugar (12g), energy (102kcal), phenolic content (290mg), flavonoid (180mg) & antioxidant activity (72%). The BAU2 varieties contain the highest amount of ash (0.9%) & lowest amount of protein (1.5g), vitamin c (3,8mg), K (269mg), Mg (65mg), Fe (0.9mg) & fiber (3.5gm). The Fat content is absent in all types of dragon fruit varieties; the amount of fat is 0. To compare the nutrition value of among the 3 fruit varieties BARI1 showed the better result.

Index Terms- antioxidants, phenolic content, flavonoid etc.

I. INTRODUCTION

Dragon Fruit (*Hylocereus polyrhizus*) is considered to be a promising, remunerative fruit crop. Fruit has very attractive colour and mellow mouth melting pulp with black colour edible seed embeded in the pulp along with tremendous nutritive property which attracts the growers to cultivate this fruit crop which is originated in Mexico and Central and South America. It is a long day plant with beautiful night blooming flower that is nicknamed as “Noble Woman” or “Queen of the Night”. Fruit is named as pitaya because of the bracts or scales on the fruit skin and hence the name of pitaya meaning ‘‘the scaly fruit. Pitaya fruit is among the most nutritious and wonderful exotic fruits. It is a favorite to many, particularly people of Asian origin. There are 3 types dragon fruit based on their colour.

- Red colour fruit with white colour flesh.
- Red colour fruit with red colour flesh.
- Yellow colour fruit with white colour flesh.

Dragon fruit (Hylocereus spp.) is a tropical climbing cactus. It is also known as pitaya or pitahaya in Latin America (Le Bellec et al., 2006), päniniokapunahou or päpipi pua in Hawaii, and night-blooming cereus or strawberry pear in Southeast Asia (Zee et al., 2004). The fruit crop is grown in the subtropical and tropical countries, and is normally available all year round. Dragon fruit is very attractive because of its exotic appearance. The pulp is juicy and contains numerous small black seeds. It is also considered as a potential source of micronutrients and antioxidants (Ariffin et al., 2009: Jaafar et al., 2009: Lim et al., 2010a: Lim et al., 2007: Mahattanatawee et al., 2006: To et al., 1999: Wu et al., 2006). The seeds are eaten together with the flesh, have a nutty taste and are rich in lipids (Abdul Azis Ariffin et al., 2008). The seeds of dragon fruits are high in polyunsaturated fats (omega-3 and omega-6 fatty acids) that reduce triglycerides and lower the risk of cardiovascular disorders. Eating dragon fruit can help the body to maintain such normal function as ridding the body of toxic heavy metals and improved eyesight. Lycopene, responsible for the red color in dragon fruit, has been shown to be linked with a lower prostate cancer risk

Dragon Fruit production is gaining more and more recognition as an important crop. It is a nutritious fruit with a variety of uses. The fruit pulp can be eaten fresh and can be made into various valuable processed products. The fruit possesses medicinal properties: it is known to prevent colon cancer and diabetes, neutralizes toxic substances such as heavy metals, reduce cholesterol and high blood pressure. It is also reported to control high sugar levels, prevent cancer and bleeding, and promote dental health. Dragon fruit helps improve digestion and reduce fat. It helps maintain the health of eyes.

In addition, it has the ability to promote the growth of probiotics in the intestinal tract (Zainoldin and Baba, 2012). In Bangladesh, it is newly extending in all the area. It is important to select the soil media where it can grow well which will help to provide the planting materials of dragon fruit to the whole country of Bangladesh.

II. MATERIALS

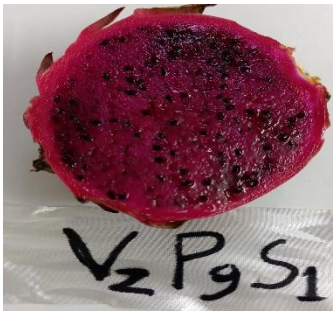
The experimental site and planting materials:

This experiment was accompanied at the BIRTAN Head office at Araihazar in Narayangonj during the period from December 2020 to August 2021. The experimental field was situated between 20.40^0 and 23.53°N latitude and in between 90.35°and 90.45E longitude and having altitude of 17m from sea level. The soil was sandy loam type within the experimental field going to AEZ 16 the Middle Meghna river Floodplain Tract having non-calcareous dark grey flood plain soil. The studied area was under medium high land, well drained, fertile and slightly acidic with pH ranges from 6.0 to 6.8. During the study period the average maximum temperature was 35.20 ºC, minimum maximum temperature was 22.50 °C and relative humidity 86.45%. The selected planting materials were planted one year before and fully in production stage for this year. BAU Dragon 1 (White flesh), BAU Dragon 2 (Red flesh) and BARI Dragon Fal-1 (Red flesh) were taken under consideration for this experiment. There harvested 60 plants of 3 varieties of dragon fruit each variety have 20 plant & then selected the 9 sample randomly each variety have 3 sample.

For BAU Dragon 1 (White flesh),

Here, V_1= BAU Dragon 1 (White flesh), P (9,8,17)= plant Number & S (1,2,3)= Sample number.

For BAU Dragon 2 (Red flesh),



Here, V_2= BAU Dragon 2 (Red flesh), P (9,14,20)= plant Number, S (1,2,3)= Sample number.

For BARI Dragon Fal-1 (Red flesh),

Here, V_3= BARI Dragon Fal-1 (Red flesh), P (4,19,9)= plant Number & S (1,2,3)= Sample number.

Determination the Moisture content:

Moisture content of different dragon fruit samples were determined by oven drying methods (AOAC 2005). The moisture content is highly dependent on the type of oven used, conditions of the oven, time and temperature of drying. The different samples are heated under specific conditions and loss of weight is used to calculate the moisture content of the sample.

The moisture content expressed by the calculation,

% of Moisture content= $\frac{W1-W2}{W} \times 100$

Where,

W_1 = Weight of sample before drying + petri dish

W_2 = Weight of sample after drying+ petri dish

W= Weight of raw sample before drying

Determination the Ash content:

To determine of Ash content of different dragon fruit varieties by official method of (AOAC, 2005). In this method, the sample is burned and the loss of weight is used to calculate the ash content of the sample.

The Ash content is expressed by the calculation,

% of Ash content = $\frac{W2-W}{W1-W} \times 100$

Where,

W2=Weight of the crucible + ash.

W1=Weight of the empty crucible.

Determination of Fat Content:

Total fat content of different varieties of dragon fruit determined by organic solvent extraction methods followed by AOAC (2005). The accuracy of these method greatly depends on the solubility of fat in the solvent used. The fat content of any sample determined by extraction with one solvent may be quite different from the content determined with another solvent with different polarity. Using SXT-06 Fat extraction machine for determined the fat content.

The total fat content is expressed by the calculation,

% of fat content= $\frac{A-B}{W} \times 100$

Where,

A= Weight of conical flask + extracted oil

B= Weight of conical flask

W= Sample weight.

Determination of Carbohydrate: The content of available carbohydrate of the samples was determined by subtracting the sum of the values of moisture, ash, protein and fat from (per 100 gm) (Md. Imdad Talukdar et all, 2014).

% of Carbohydrate content = 100 – (Moisture + Protein + Fat + Ash).

Determine the total Protein content:

The total protein content of fruit samples were determined by using the Kjeldahl method (AOAC, 2005). About 1gm of raw sample and total 5 gm cupric sulfate and potassium sulfate (0.06 gm cupric sulfate + 4.940 gm potassium sulfate) was taken on kjeldahl flask. After 20 ml 98% concentrated sulfuric acid was taken in each flask by pipette. Then the Kjeldahl flasks were taken on digestion machine at 420°C for 2 hours for digestion until the solution became clear & after the flasks were cooled at room temperature (32°C) for several hours. After digestion the each Kjeldahl flask were taken into distillation chamber. Then water and NaOH was placed at the Kjeldahl apparatus & then the distillation apparatus was switched on for 5 minutes and distilled solution was collected in a conical flask. After the machine was stopped and conical flask was removed from the apparatus. In this way sixteen different distillation solution were

collected one after another. The collected samples from Kjeldahl apparatus was titrated against 0.1N HCl respectively until the color became reddish. The nitrogen percent was calculated by the following formula.

% of nitrogen= $\frac{\{(S-B)\times N\times 0.014\times F\times 100}{W}$

Where,
S = Sample titration reading
B = Blank titration reading
N = Normality of HCL
W=Sample weight.
0.014 = Milli equivalent weight of Nitrogen
F= Most protein contains 16 percent nitrogen, so the conversion factor is 6.25 (100/16=6.25).

Determination the total Sugar:

Sugars (total sugar, reducing sugar and non-reducing sugar) were determine by Lane and Eynon Method as described by (James et all, 1995).

Determination the Energy content:

The energy contents of all dragon fruit varieties determined by calculating the amount of protein, fat and carbohydrate of dragon fruit. (Md. Imdad et all)

Calculation: Energy = (Protein×4.1) + (fat ×9.3) + (carbohydrate×4.1)

Determination the Vitamin C content:

Vitamin C content of fruits and vegetables is usually determined by official method of vitamin C estimation, AOAC (2005). 5gm of each sample was taken mixed well with 3% HPO3 in a flask separately and made the volume up to 100ml. Then the samples were filtered with Whitman paper 40. Each extraction was titrated with dye until a faint pink color persisted for 15 seconds

The total Vitamin C content is expressed by the calculation,

$$a = \frac{(bcd\times 100)}{ef}$$

Where,
a = vitamin C content as mg/100g
b = titration value for sample
c = Dye factor
d = Volume made up (100ml)
e = Aliquot of extract (5ml)
f = weight of sample (5gm)

Determination of Potassium (K):

To determine the Potassium from all varieties of dragon fruit followed by the (AOAC ,2005) method. Estimation of potassium content calculated by following formula,

K, mg/100gm = $\frac{(ppm\times volume\times Dillution\times 100)}{(W\times 1000)}$

Where,
W = Sample weight
Volume = 50
Dilution = 100

Determination of Iron (Fe):

All of dragon fruit varieties used to (AOAC, 2005) official method for determined the total Iron content. Atfrist take 5 ml sample in a test tube then add 0.5ml 30% H2SO4, 0.5ml potassium persulphate & 0.5ml Potassium Thiocyanate. Make a blank sample with 2ml HNO3, 10ml distilled water ,0.5ml 30% H2SO4 ,0.5ml potassium persalphate and 0.5ml potassium thiocynate after 20 min and take absorbance at 540 nm.

Iron, mg/100gm= $\frac{UV\ reading\times Taken\ sample\times 100}{(m\times w)}$

Where,

w = Weight of dry sample for ash
m = Conversion factor (13.782)

Determination of Calcium (Ca):

Total Calcium content of the fruits were measured by the official method of AOAC, 2005. The measurement of the calcium, usually and most conveniently as oxalate, can be made the least variable and most perfect part of the analysis. The dissolved oxalate can be calculated by titration with potassium permanganate (Sendroy Jr, J. 1944). The total Ca content was expressed by the formula.

$$\text{Calcium (mg/100gm)} = \frac{(titer \times 0.2 \times total\ volume\ of\ ash\ solution \times 100)}{V \times W}$$

Where,
V=volume taken for estimation.
W=Weight of sample taken for ashing.

Determination of Magnesium (Mg):

Magnesium was determined by complexometric titration using EDTA as complexing agent. The better amount of Magnesium present in the whole of the fruit sample was calculated from the titre value (A. Anish Babu et all, 2016).

Determination of total Phenolic content:

Total Phenolic Content of methanolic extract from all dragon fruit varities were determined by the Folin- Ciocalteu method. Folin – ciocalteu Assay (F-C) is one of the most popular assays for phenolic analysis (Makkar Hps, 2003). The principle of the F-C assay is the reduction of the Folin-Cocalteu reagent (FCR) in the presence of phenolics resulting in the production of molybdenum-tungsten blue that is measured spectrophotometrically at 765nm and the intensity increases linearly with the concentration of phenolic content in the reaction medium (Dildar *et al*., 2015).

Determination the IC_{50} Content :

The IC50 values of all dragon fruit varieties by using the UV-vis Spectophotometer (Bryan Brummelhaus de Menezes, 2021). It was done by ISIR Laboratory, JUST.

Determination the total flavonoid content:

Aluminum Chloride Colorimetric technique was used for flavonoids estimation. Take 300 µL extract in a test tube then 3.4 mL aqueous ethanol (30%) was added to obtain a clear solution. Then, 150 µL aqueous sodium nitrite solution (0.5 M) was added followed by 150 µL aluminum chloride solution (0.3 M). After 5 min, 1 mL sodium hydroxide solution (1 M) was added, and the content was mixed well before measuring its absorbance at 506 nm on a UV visible spectrophotometer against a blank, which was prepared by the same procedure except replacing the fruit extract with an equal volume of ethanol. A calibration curve of Quercetin was obtained and the total flavonoid content of each extract was expressed as µg of Quercetin equivalents (QE) per mL, calculated using the formula, y = 0.0069 x – 0.0304, where, y is the absorbance at 506 nm and x is the amount of Quercetin equivalent (µg/mL). Then convert the value mg of QE per 100g (mg QE/100g). (Dilder et all 2015)

Determination the Antioxidant activity:

Antioxidant activity can be determined by scavenging of radical 2,2- diphenyl-1- picrylhydrazyl (DPPH) as described by (Kevers et al.,2007). The DPPH radical is purple in color and upon reaction with hydrogen donor's changes to yellow in color. It is a discoloration assay, which is evaluated by the addition of the antioxidant to a DPPH solution in methanol taken the absorbance at 517 nm. At first the blank solution was prepared. The blank standard used was of 2,2- diphenyl-1-picrylhydrazyl (DPPH) radical solution mixing 1 ml of 2,2-diphenyl-1-picrylhydrazyl with 3ml of 95% ethanol (3 times diluted). Then, 100µl sample extract taken and added 3ml diluted DPPH solution in tube. After that the solution were vortex thoroughly and incubated 30 minutes in dark box at 37°C.Then half hour later, absorbance was taken at 517 nm against a blank sample lacking scavenger. Scavenge the DPPH radicals was calculated using the following equation. (Untalan *et al.*,2015).

$$\text{The DPPH scavenging effect \%} = 1 - \frac{As}{Ac} \times 100$$

There,
As = The absorbance in the presence of sample
Ac = The absorbance of the control (Diluted DPPH solution with methanol)

Determination of total fiber content:

To determination of total fiber content for all dragon fruit varieties by Weende method (AOAC Official method 978.10). The total amount of fiber content calculated by following formula,

% Crude Fiber = $\frac{(W1-W2)}{W} \times 100$

Where,
W1 = weight of crucible with fiber.
W2 = weight of crucible with ash.
W= weight of sample.

Statistical analysis

Replicate samples were averaged to obtain replication means. Mean data of triplicate samples were also statistically analyzed by ANOVA using Statistics' 10 software, and the means were compared by Turkey's HSD test at a 1% level of probability. The results were reported as the average of three replications ± SD.

Result & Discussion:

The effectiveness of research showed the different nutrition value of 3 types of dragon fruits such as BAU Dragon 1 (White flesh), BAU Dragon 2 (Red flesh) & BARI Dragon 1 (Red flesh). The 3 types of dragon fruits express the different nutritive value based on their physical & chemical properties.

Table: Effect of different Nutritive value on Test parameters of dragon fruit.

Test parameter	BAU1	BAU2	BARI1
Moisture content (%)	89%	83%	86%
Ash%	0.8%	0.9%	0.85%
Fat	0	0	0
Carbohydrate	11.5g	12.9g	22g
Protein (g/100g)	2g	1.5g	1.7g
Energy	102 kcal	103 kcal	109 kcal
Sugar (g/100g)	12g	12.12g	13g
Vitamin C(gm/100gm)	4mg	3.8mg	5.6mg
Potassium (mg/100gm)	275mg	269mg	270mg
Magnesium(mg/100gm)	68mg	65mg	72mg
Iron(mg/100g)	1mg	0.9mg	1mg
Calcium(mg/100g)	35mg	35mg	35mg
Phenolic Content (mg/100gm)	290mg	316mg	326mg
IC50 (powder)	975.125ppm	1012.105ppm	1200.95ppm
Flavonoide (mg/100gm)	180mg	195mg	210mg
Antioxidant activity %	72%	78%	81%
Fiber (Moiature free) gm/100g	5gm	3.5gm	4.25gm

In a column, figures sharing similar letter(s) are not statistically different at P = 5%

Moisture Content %:

Among the fruits showed the different amount of moisture content BAU dragon-1 89%, BAU dragon-2 83% & BARI dragon Fal-1 86%. Here BAU dragon-1 showed maximum value & BAU dragon-2 showed minimum value compared than another.

Ash% content:

No significant difference among different type of dragn fruit was observed amount of ash content. BAU1 showed 0.8%, BAU2 showed 0.9% & BARI1 showed 0.81% of Ash content. Maximum Ash content 0.9% was found in BAU2 & minimum 0.8% was found in BAU1.

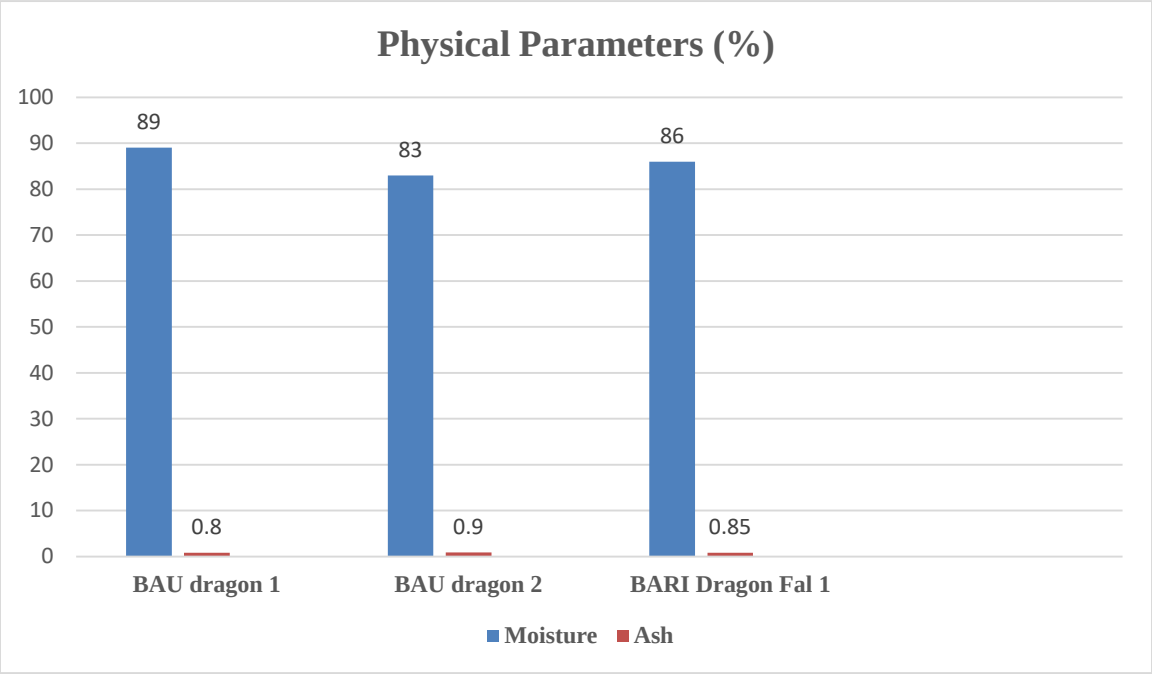


Figure 1: Physical Parameters (%) of BAU dragon-1, BAU dragon-2 and BARI dragon Fal-1

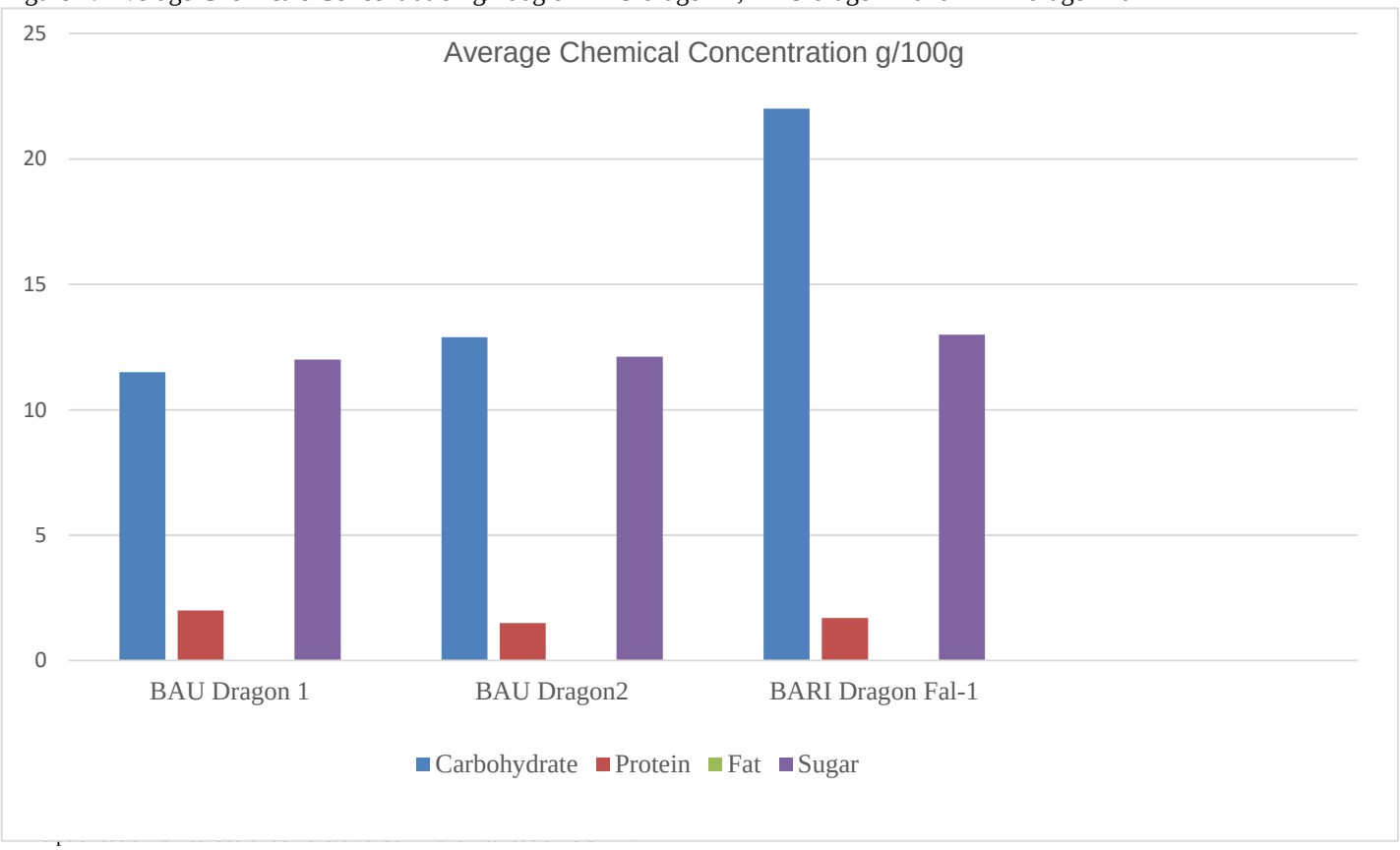
Fat (g/100g):

There was no fat in all types of dragon fruit. Total amount in fat BAU1 showed 0, BAU2 showed 0 & BARI1 also showed 0.

Carbohydrate (g/100g:

Among different types of dragon fruit variety maximum carbohydrate value 22gm (gm/100gm) was found in BARI1 & minimum 11.5gm was found in BAU1. There the BAU2 showed middle amount of carbohydrate value 12.9g compared with other.

Figure 2: Average Chemicals Concentration g/100g of BAU dragon-1, BAU dragon-2 and BARI dragon Fal-1



Protein (g/100g):

Protein content of the dragon fruit varieties BAU1 express the maximum value 2gm (gm/100gm) & minimum value 1.5gm was found in BAU2. To Compared with another BARI1 showed the middle value 1.7gm (gm/100gm)

Sugar (g/100g):

13g (g/100g) sugar present on BARI1 variety which indicates the maximum value of sugar,BAU 2 showed 12.12g sugar value which was indicated the minimum value & BAU1 showed 12g sugar value which was indica.

Energy:

All types of dragon fruit under the test express energy level gradually 102kcal for BAU1, 103kcal for BAU2 & 109kcal for BARI1. Analyzing this result BARI showed maximum energy level & BAU1 showed the minimum level.

Vitamin C:

Among different types of dragon fruit BARI1 showed the maximum value 5.6mg/g. BAU2 showed the minimum value 3.8mg/g & BAU1 showed 3.8mg/g which was indicated the middle value.

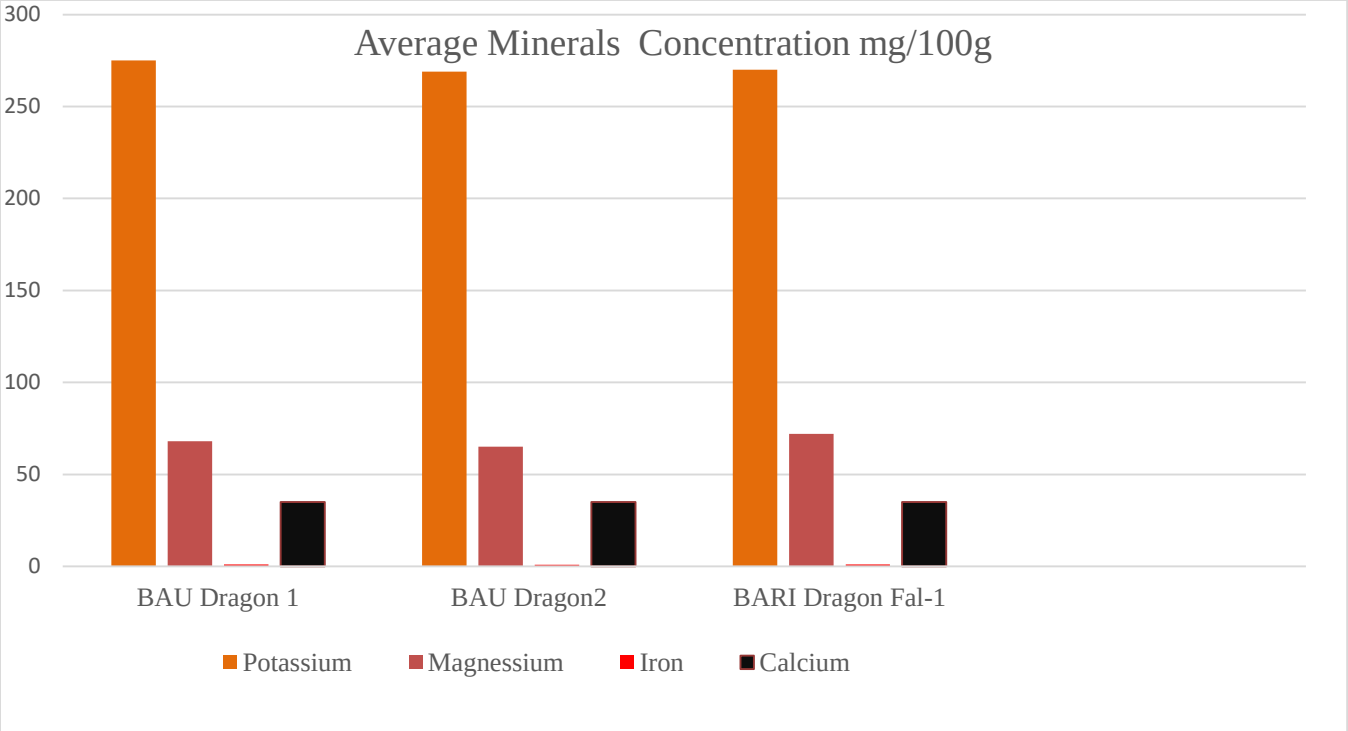


Figure 3: Average Minerals Concentration mg/100g of BAU dragon-1, BAU dragon-2 and BARI dragon Fal-1

Potassium (K):

Potassium (K) content of the dragon fruit varieties showed 275mg/g for BAU1, 269mg/g for BAU2 & 270mg/100g for BARI1. BAU1 expressed the maximum Potassium content & BAU2 expressed the minimum Potassium content.

Magnesium (Mg):

In the test parameter of all types dragon fruit BARI1 showed the maximum level of Mg content 72mg/100g, BAU1 showed minimum 68mg/g & BAU2 showed middle level 65mg/g of Mg content compared with each other.

Iron (Fe):

To compared with each other BARI1 & BAU1 showed 1mg/100gm of Iron content which indicated the maximum value & BAU2 showed 0.9mg/g which was indicated the minimum level of Iron present on the Dragon fruits.

Calcium (Ca):

No significant difference among different types of dragon fruit was observed amount of Calcium content. BAU1, BAU2 & BARI1 showed 35mg/g of Calcium level.

Phenolic content:

The total amount of phenolic content in all types' dragon fruit 290mg/g for BAU1, 316mg/g for BAU2 & 326mg/g for BARI1. Here BARI showed the maximum level & BAU1 showed the minimum level of phenolic content.

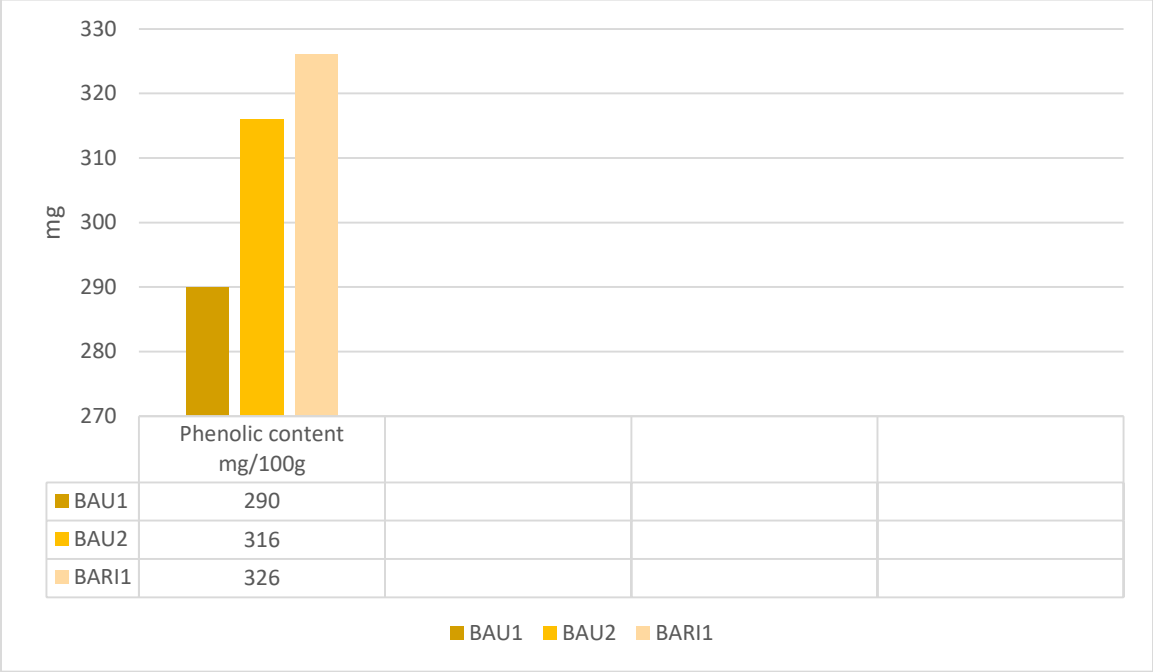


Figure: Total Phenolic content of different types of dragon fruit varieties such as BAU1, BAU2 & BARI1.

IC_{50} (Half-maximal inhibitory concentration):

IC_{50} is the most widely used & informatory measure of a drugs efficiency. Among different types of dragon fruit BARI1 showed 1200.95ppm which was maximum IC_{50} value. BAU2 showed 1012.105ppm of IC_{50} value & BAU1 showed 975.125 ppm which was minimum IC_{50} value.

Flavonoid content:

Flavonoid content of the all types of dragon fruit exposed 180mg/100g for BAU1, 195mg/g for BAU2 & 210mg/g for BARI1. Maximum value of flavonoid content found in BARI1 & the minimum value found in BAU1.

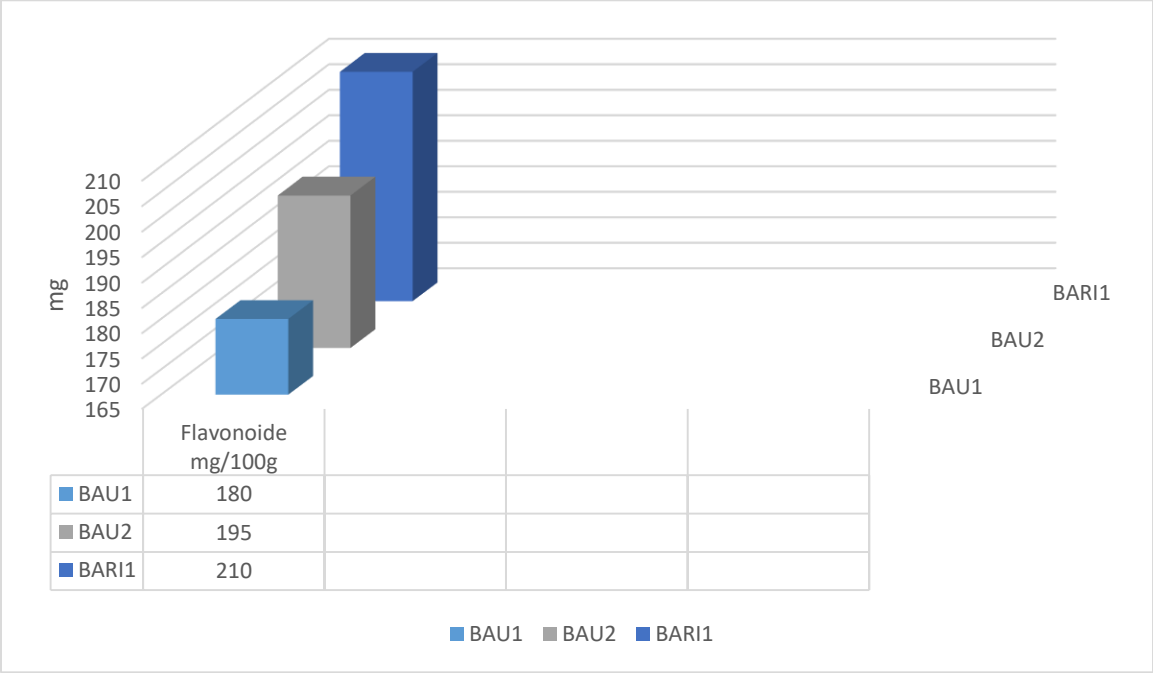


Figure: Total Flavonoids content of different types of dragon fruit varieties such as BAU1, BAU2 & BARI1.

Antioxidant activity:

Among the differences of all types dragon fruit the maximum amount of antioxidant activity found in BARI1 81% & the minimum amount of antioxidant activity found in BAU1 72%. Compared to each other the BAU2 78% showed the middle amount of antioxidant activity.

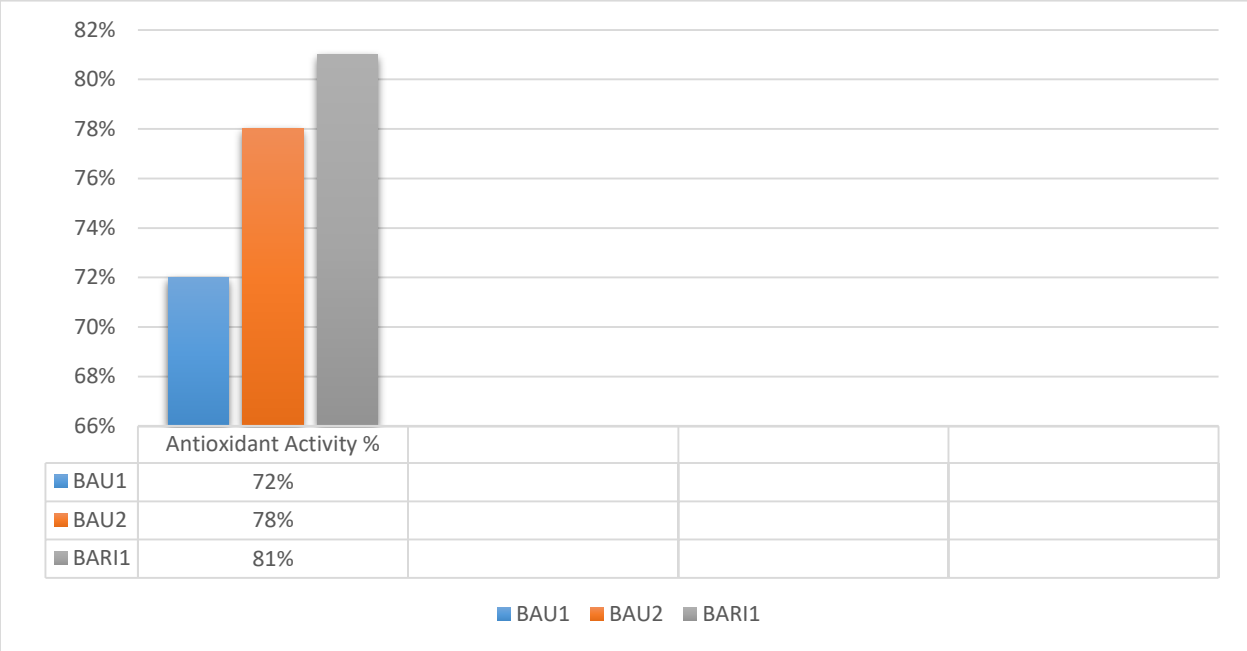


Figure: Total antioxidant activity of different types of dragon fruit varieties such as BAU1, BAU2 & BARI1.

Fiber (moisture free):

The total amount of fiber content of dragon fruit varieties expressed 5gm/100ml for BAU1, 3.5mg/100ml for BAU2 & 4.25mg/100gm for BARI1. To compare with each other the maximum amount of fiber content found in BAU1 & minimum amount of fiber content found in BAU1 & BARI1 indicated the middle amount of fiber content.

Conclusion:

Analysing all the result we observed that BARI1 variety showed highest energy and nutritional value than BAU dragon 1 and BAU dragon 2 varieties.

REFERENCES

[1] Abdul Azis Ariffin, Jamilah Bakar, Chin Ping Tan, Russly Abdul Rahman, Roselina Karim, and Chia Chun Loi. 2008. Essential fatty acids of pitaya (dragon fruit) seed oil. Food Chemistry, 114 (2): 561-564.

[2] Ariffin, A.A., J. Bakar, C.P. Tan, R.A. Rahman, R. Karim, and C.C. Loi, 2009. Essential fatty acids of pitaya (dragon fruit) seed oil. Food Chemistry 114: 561-564.

[3] Jaafar, R.A., A.R.B.A. Rahman, N.Z.C. Mahmod, and R. Vasudevan, 2009. Proximate analysis of dragon fruit (Hylecereus polyhizus). American Journal of Applied Sciences 6: 1341-1346.

[4] Le Bellec, F., F. Vaillant, and E. Imbert, 2006. Pitahaya (Hylocereus spp.): a new fruit crop, a market with a future. Fruits 61: 237-250.

[5] Lim, H.K., C.P. Tan, R. Karim, A.A. Ariffin, and J. Bakar, 2010a. Chemical composition and DSC thermal properties of two species of Hylocereus cacti seed oil: Hylocereus undatus and Hylocereus polyrhizus. Food Chemistry 119: 1326-1331.

[6] Lim, Y.Y., T.T. Lim, and J.J. Tee, 2007. Antioxidant properties of several tropical fruits: A comparative study. Food Chemistry 103: 1003-1008.

[7] Mahattanatawee, K., J.A. Manthey, G. Luzio, S.T. Talcott, K. Goodner, and E.A. Baldwin, 2006. Total antioxidant activity and fiber content of select florida-grown tropical fruits. Journal of Agricultural and Food Chemistry 54: 7355-7363.

[8] To, L.V., N. Ngu, N.D. Duc, D.T.K. Trinh, N.C. Thanh, D.V.H. Mien, C.N. Hai, and T.N. Long. 1999. Quality assurance system for dragon fruit The Australian Centre for International Agricultural Research Proceedings 100, Ho Chi Minh City, Vietnam.

[9] Wu, L.-c., H.-W. Hsu, Y.-C. Chen, C.-C. Chiu, Y.-I. Lin, and J.-a.A. Ho, 2006. Antioxidant and antiproliferative activities of red pitaya. Food Chemistry 95: 319-327.

[10] Zainoldin KH and AS Baba, 2012: The effect of Hylocerouspolyrhizus and Hylocerousundatus on Physicochemical, Proteolysis and Antioxidant Activity in Yogurt. International Journal of Biological and Life Science, 8: 93-98.

[11] Zee, F., C.-R. Yen, and M. Nishina, 2004. Pitaya (dragon fruit, strawberry pear). Fruits and Nuts 9: 1-3.

AUTHORS

First Author – Md. Shariful Islam[1], Scientific Officer, Bangladesh Institute of Research and Training on Applied Nutrition (BIRTAN),e-mail:rsharifulislam4972@gmail.com
Second Author – Prince Biswas[1], Scientific Officer, Bangladesh Institute of Research and Training on Applied Nutrition (BIRTAN), e-mail: princebiswas211@gmail.com
Third Author – Md. Maksudul Haque[2], Senior Scientific Officer, Bangladesh Institute of Research and Training on Applied Nutrition (BIRTAN), e-mail: maksudulhq@gmail.com
Fourth Author – Elora parvin[1], Scientific Officer, Bangladesh Institute of Research and Training on Applied Nutrition (BIRTAN), e-mail: elorasau@yahoo.com
Fifth Author – Md. Musfikus salehin[1], Scientific Officer, Bangladesh Institute of Research and Training on Applied Nutrition (BIRTAN), e-mail: musfikus.salehin@gmail.com
Sixth Author – Mursaleen Zebin Turin[1], Scientific Officer, Bangladesh Institute of Research and Training on Applied Nutrition (BIRTAN), e-mail: turinbsmrau@gmail.com
Seventh Author – Sonia Sarmin[1], Scientific Officer, Bangladesh Institute of Research and Training on Applied Nutrition (BIRTAN). E-mail : soniabrtn1@gmail.com