INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print), 2222-5234 (Online)
http://www.innspub.net
Vol. 14, No. 5, p. 440-449, 2019

RESEARCH PAPER OPEN ACCESS

Probing the antioxidant status and total phenolic contents of sweet basil seeds and its functional drink

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Key words: Sweet basil seeds, Hyperglycemia, Nutraceutical, Functional foods.

http://dx.doi.org/10.12692/ijb/14.5.440-449 Article published on May 26, 2019

Abstract

In the modern era, nutritionists are determined to improve public health and discover particular innovative approaches for subsiding the lifestyle related disorders. Diet based therapy is considered as most effective owing to its health promoting perspectives. Keeping in this view the present study was planned to characterize sweet basil seeds (*Lallemantia royleana*), for antioxidant activity and total phenolic contents. For the purpose, raw material (*Lallemantia royleana* seeds) was procured from local market, Faisalabad and bioactive moieties were extracted with n-hexane, methanolic and ethanolic solvents from them. In addition, chemical characterization was carried out through respective methods. Furthermore, anti-oxidant activity of methanolic seed extract as well as drink prepared with the extracts of *L. royleana* were ascertained in vitro by super oxide scavenging activity by DPPH free radical scavenging activity, TPC and FRAP. Compositional analysis elucidated that sweet basil seeds are good sources of fiber (4.87 %) and protein (22.40 %). The results for extraction depicted high extraction yield in methanolic extracts 1.81g/100g followed by ethanol 1.42g/100g and n-hexane 1.13g/100g. Moreover, Sweet basil seed extract contained DPPH (9.47mg/ml) and FRAP (15.69mM FRAP/g). Furthermore, results regarding DPPH (2.50±0.04 to 2.31±0.59) FRAP (4.22±0.07 to 4.01±0.05) and TPC (4.09±0.97 to 2.22±0.66) showed gradual decrease on the storage ability of the drink. Rooted from study, it can be concluded that the plant extract should be used for the treatment of numerous aliments caused by oxidation.

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Introduction

Lallemantia royleana, also recognized as sweet basil (Shweta, Akanksha, Nayyar, & Pramod, 2016) belonging to the family Lamiaceae and the common name of *Lallamantia royleana* in English and Urdu are Lady's mantle and Tukhummalanga(Mahmood *et al.*, 2013). Basil seed gum has a globular structure with diameter about 3.2 um (Rafe, Razavi, & Farhoosh, 2013). *L. royleana*seeds are affluent font of carbohydrates, fibre, oil, protein, tannins (S. M. Razavi *et al.*, 2009; Moghaddam, Razavi, & Emadzadeh, 2011; Pirani, Moazzeni, Mirinejad, Naghibi, & Mosaddegh, 2011;). The seeds extract restrains Alkaloids, Anthraquinones, Flavonoids, Glycosides, Pholobtannins, Tannins and Terpenoids. The antioxidant activity found in DPPH method is more proficient than hydrogen peroxide scavenging method. The results of GCMS analysis demonstrated that at least 21 compounds are present in methanolic extract of L. royleana. The methanolic extract of L. royleana seeds are good source of natural antioxidant with continuing considerable antioxidant activity (Fatima, Mansoor, Saadia, Rehman, & Mustafa, 2016).*Lallementiaroyleana* L. seeds are used in traditional drinks and deserts all over the world particularly in Asia and Africa.

As being low in cost, these compounds can offer sanctuary against certain chronic diseases in developing countries. Sweet basil seeds possess numerous health promoting properties which are valuable in countries having low purchasing power index. These properties include their anti-oxidant, anti-obesity, anti-hypercholesterolemic, anti-hyperglycemic and anticancer nature. It is an important folk medicine which is used in number of ailments due to having antioxidant activity and high fiber contents (Fatima *et al.*, 2016). The basil extract can exhibit the in-vitro hypoglycemic activity through a mechanism involving the significant dose-dependent inhibition against intestinal sucrose, maltose and porcine pancreatic α-amylase shown by extract. The inhibition against maltose is noticeable as compared to sucrose. These effects may be owing to the high level of total polyphenol content and flavonoid contents. The results illustrate that basil extract through antioxidant and possibly α-glucosidase and α- amylase inhibiting activities, accessible good retort to control diabetes (El-Beshbishy & Bahashwan, 2012). Keeping in view the need of time and benefits of sweet basil seeds, the current trial was designed to determine the antioxidant profile of basil seeds and storage ability of functional drink prepared with different treatments.

Materials and methods

Procurement of raw material

Sweet basil seeds (*Lallementia royleana* L.) were procured from local market, Faisalabad. The seeds were washed thoroughly under running tap water to remove adhered dirt, dust and other foreign debris.

Chemical analysis

The sweet basil seeds were analyzed for the proximate composition i.e. moisture content (Method No. 44-01), crude protein (Method No. 46-13), crude fat (Method No. 30-10), crude fiber (Method No. 32-10), total ash content (Method No. 08-01) and nitrogen free extract according to their respective protocols mentioned in AACC (2000). The nitrogen free extract (NFE) was calculated by difference method.

Minerals analysis

The basil seeds were subjected to mineral analysis following the guidelines of Latimer (2012). The sodium (Na) and potassium (K) were assessed by Flame Photometer-410 (Sherwood Scientific Ltd., Cambridge) whilst, calcium, zinc (Zn), magnesium (Mg) and iron (Fe) were determined through Atomic Absorption Spectrophotometer (Varian AA240, Australia).

Preparation of extracts

Ground samples (15 g) were extracted with 150 mL methanol solvent each in a separate conical flask. 80% methanol was employed for extraction. The extracts were separated from solids by filtering through Whatman No. 1 filter paper. The extracts were concentrated under reduced pressure using

rotary evaporator. Concentrated extracts were stored at 4°C until tested and analyzed. Following the same protocol, n-hexane & ethanolic extracts were prepared.

Anti-oxidant activities

Antioxidant activity of the functional drink was monitored using assay based on coupled oxidation of βcarotene and linoleic acid (Taga, Miller, & Pratt, 1984).

Free radical scavenging activity (DPPH assay)

The free radical scavenging activity i.e., DPPH (1, 1-diphenyl-2-picrylhydrazyl) of extracts was measured using the protocol of Muller, Lustgarten, Jang, Richardson, and Van Remmen (2007).

Ferric reducing antioxidant power (FRAP)

The ferric reducing power of extracts was estimated according to the protocol of Yuan, Quataert, and Narayan (2003).

Determination of total phenolic content (TPC)

Folin-ciocalteu reagent technique was used to determine the TPC by following procedure as described Yuan *et al.* (2003).

Preliminary Phyto-chemical Screening

The preliminary phyto-chemical investigation was carried out for methanolic extracts of seeds of *L. royleana* for the detection of various phyto-constituents i.e. alkaloids (Wagner's test), anthraquinone (Borntrager's test), flavonoids, phlobatannins, glycosides (Fehling's test), saponins (Frothing test), steroids (Salkowski test), tannins (Ferric chloride test), terpenoids(Salkowski test) by using standard procedures to identify the constituents (Hegde & Joshi, 2010; Prashant, Bimlesh, Mandeep, Gurpreet, & Harleen, 2011Mir, Sawhney, & Jassal, 2013).

Product development

In the present study functional drink were prepared by incorporating the different treatments. All the treatments of functional drinks have the same recipe except the presence or absence of active ingredients as given in Table 1.

Physicochemical Analysis of functional drink

Total soluble solids in functional drink samples were estimated by hand refractometer (TAMCO, Model No. 90021, Japan) and results were expressed as percent soluble solids (°Brix) whereas pH were calculated according to method described in AOAC (1990).Total acidity of functional drinks was determined by titrating samples against 0.1N sodium hydroxide solution to persistent pink color following protocols of AOAC (1990).

Antioxidant activity

Antioxidant activity of the functional drink was monitored using assay based on coupled oxidation of βcarotene and linoleic acid Taga *et al.* (1984).

Total polyphenols (TP) were measured by using Folin-Ciocalteu method following the protocol of Singleton, Orthofer, and Lamuela-Raventós (1999). DPPH radical scavenging activity was determined as IC_{50} value following the procedure described by Bozin, Mimica-Dukic, Simin, and Anackov (2006) using 1, 1-diphenyl-2- picrylhydrazyl (DPPH) whereas FRAP test was performed according to the method of Sun, Fu, Chen, Jiang, and Pan (2010).

Statistical analysis

The generated data was being applied by completely randomized design (CRD) and further subjected to statistical analysis using Cohort version 6.1 (Costat-2003). Analysis of variance technique (ANOVA) was used to determine the level of significance (Steel and Torrie, 1997).

Results and discussion

Proximate analysis and mineral profile

The nutritional composition of "sweet basil seeds" is depicted in Table 2. The results revealed that the moisture, crude protein, crude fat, crude fiber and ash contents in *L. royleana*seeds powder were 6.10±0.25, 22.4±0.62, 20.2±1.01, 4.87±0.49 and 4.79±0.32g/100g, correspondingly.

Table 1. Product development.

Treatment	Extract %
T_0	0
T_1	0.5%
T_2	1.0%
T_3	1.5%

Table 2. Proximate analysis of *L. royleana* seeds and mineral profile.

Proximate assay (%)	
Moisture	6.10±0.25
Crude protein	22.40±0.62
Crude fat	20.20±1.01
Crude fiber	4.87±0.49
Ash	4.79±0.32
NFE	51.60±2.45
Minerals (mg/100g)	
Potassium (K)	14.88±0.42
Calcium (Ca)	2.99±0.96
Sodium (Na)	3.03±0.15
Iron (Fe)	1.61±0.08
Zinc (Zn)	5.12±0.55

Means ± Standard deviation.

These results were in line with the findings of Razavi*et al* (2008)for all the proximate characteristics except fiber contents. They described balangu seeds contained moisture content of 7.82%, ash (3.63%), crude protein (25.60%), crude fat (18.27%), and crude fiber (1.29%). The variation in fiber contents may be due to varietal differences. Similarly minerals were calculated from the seed powder sample and the results for potassium (K), calcium, sodium (Na), iron (Fe) and zinc (Zn) were recorded as 14.88.45±0.42, 2.99±0.96, 3.03±0.15, and 1.61 ±0.08 and 5.12±0.55 mg/100 respectively.

Table 3. Extraction yield with different organic solvents.

Sample	Yield g/100g
Ethanol	1.42±0.07
Methanol	1.81±0.21
n-hexane	1.13±0.02

Means ± Standard deviation.

Extraction of non-volatile compounds

The present study was demeanored to extract the non-volatile compounds from *L. royleana* seeds powder. Extraction of *L. royleana* seeds was done with methanol n-hexane and ethanol and the extraction yield was calculated as g/100g. The yield of non-volatile extracts on weight/weight (w/w) basis as is shown in Table 3. Methanol extracts were higher in yield as compared to ethanol and n-hexane. The yields were 1.42±0.07, 1.81±0.21 and 1.13±0.02 for ethanol, methanol and n-hexane extracts correspondingly.

Table 4. Antioxidant indices of seed extract.

Parameters	Methanol (80:20)	Ethanol	n-Hexane
DPPH (IC_{50}) mg/ml	9.98±.23a	9.47±0.47b	9.11±0.33c
FRAP(mM FRAP/g)	16.14±0.58a	15.69±0.78b	14.93±0.43c
TPC (GAE/g)	25.3±0.32b	24.67±0.17c	25.78±0.21a

Means ± Standard deviation

Table 5. Qualitative phyto-chemical screening.

No.	Active principle	Phyto-chemical	Analysis Result
1.	Wagner's Test	Alkaloids	+
2.	Borntrager's Test	Anthraquinones	+
3.	Sodium Hydroxide (NaOH) Test	Flavonoids	+
4.	Hydrocloric Acid (HCl) Test	Phlobatanins	+
5	Fehling's Test	Glycosides	+
6.	Frothing Test	Saponins	-
7.	Salkwoski Test	Steroids	-
8.	Ferric chloride($FeCl_3$) Test	Tannins	+
9.	Salkwoski Test	Terpenoids	+

These results were analogous to the findings of Nurzynska-Wierdak*et al* (2013) who investigated essential oil composition of sweet basil cultivars and described the extraction yield of 1.3 to 1.4% in various basil cultivars.

Antioxidant activity of the sweet basil seeds

The experiment was conducted to calculate the antioxidant activity of *L. royleana* seeds extract. The confirmation of exact antioxidant activity through different assays i.e. DPPH, FRAP and TPC is essential. Methanolic extracts exhibit highest values for DPPH (9.98±.23 mg/ml) and FRAP (16.14±0.58 mM FRAP/g) whereas n-hexane depicted maximum TPC content (25.78±0.21 GAE/g) as shown in the table 4. The findings of the present study were alike to Hinneburg *et al.* (2006) as they found 2, 2-diphenyl-1-picrylhydrazyl (DPPH) values of basil which were 12.0 ± 0.10 mg/ml.

Table 6. Effect of treatments and storage days on means for TSS of functional drink.

Storage Days	Treatments				
	T_0	T_1	T_2	T_3	Mean
0	$11.19±0.65^{l}$	$11.27±0.68^{k}$	$11.37±0.54^{ghi}$	$11.43±0.73^{ef}$	$11.32±0.44^{d}$
15	$11.20±0.46^{l}$	$11.32±0.73^{ijk}$	$11.40±0.75^{efg}$	$11.49±0.65^{cd}$	$11.36±0.53^{c}$
30	$11.18±0.75^{l}$	$11.34±0.53^{hij}$	$11.40±0.52^{efg}$	$11.50±0.55^{cd}$	$11.36±0.74^{c}$
45	$11.29±0.44^{jk}$	$11.45±0.63^{de}$	$11.40±0.85^{fgh}$	$11.55±0.72^{b}$	$11.42±0.55^{b}$
60	$11.36±0.52^{ghi}$	$11.54±0.55^{bc}$	$11.50±0.52^{bcd}$	$11.64±0.51^{a}$	$11.50±0.63^{a}$
Mean	$11.25±0.74^{d}$	$11.38±0.83^{c}$	$11.41±0.53^{b}$	$11.52±0.66^{a}$	

Means ± Standard deviation

T_0= Normal Control

T_1= Functional drink containing 0.5% extract

T_2= Functional drink containing 1.0% extract

T_3= Functional drink containing 1.5% extract.

Qualitative phyto-chemical screening

Table 5 showed the results for screening test of different phyto-chemicals present in the methanolic seeds extract of *L.royleana* and their active principles. Alkaloids were tested and results showed that it was present in methanolic seed extracts. Alike, anthraquinones, flavonoids, pholobtannin, glycosides, tannins and terpenoids were tested and the results inveterated they were present in the sample.

The screening results confirmed the absence of steroids and saponins in the sample.

Table 7. Effect of treatments and storage on pH of functional drink.

Storage Days	Treatments				
	To	T_1	T_2	T_3	Mean
0	3.75±.13e	4.02±.25a	3.75±0.15e	3.75±0.13e	3.81±0.21
15	3.96±.24a	3.96±.18bc	3.97±0.17a	3.96±0.19a	3.97±0.28
30	3.93±.21b	3.93±.14bc.	3.93±0.16b	3.93±0.18b	3.93±0.19
45	3.88±.14c	3.88±.18c	3.87±0.15c	3.88±0.17cd	3.88±0.17
60	3.83±0.15cd	3.83±0.15cd	3.83±0.14cd	3.83±0.15cd	3.83±0.16
Mean	3.87±0.17	3.92±0.19	3.87±0.13	3.87±0.16	

Means ± Standard deviation

T_0= Normal Control

T_1= Functional drink containing 0.5% extract

T_2= Functional drink containing 1.0% extract

T_3= Functional drink containing 1.5% extract.

The qualitative phyto-chemical analysis of methanolic seeds extract showed the presence of alkaloids, anthraquinones, flavonoids, glycosides, pholobtannin tannins and terpenoids whilst steroids and saponins were not present. The results are in authentication with Fatima *et al.* (2016) who scrutinized phyto-chemical analysis, in-vitro antioxidant potential and GC-MS of *Lallemantia royleana* seeds extract contains alkaloids, anthraquinones, flavonoids, glycosides, pholobtannins, tannins and terpenoids.

Table 8. Effect of treatments and storage days on Acidity of functional drink.

Storage Days	Treatments				
	T_0	T_1	T_2	T_3	Mean
0	$0.36±0.02^c$	$0.36±0.01^c$	$0.35±0.01^c$	$0.35±0.02^c$	$0.35±0.03^c$
15	$0.37±0.01^c$	$0.38±0.01^c$	$0.37±0.01^c$	$0.36±0.03^c$	$0.37±0.04^c$
30	$0.40±0.03^c$	$0.41±0.01^c$	$0.38±0.01^c$	$0.39±0.03^c$	$0.39±0.02^c$
45	$0.43±0.01^b$	$0.42±0.01^b$	$0.41±0.01^b$	$0.44±0.02^b$	$0.42±0.01^b$
60	$0.44±0.02^a$	$0.44±0.02^a$	$0.46±0.02^a$	$0.48±0.02^a$	$0.46±0.02^a$
Mean	$0.41±0.01^a$	$0.40±0.02^a$	$0.39±0.01^a$	$0.40±0.02^a$	

Means ± Standard deviation

T_0= Normal Control

T_1= Functional drink containing 0.5% extract

T_2= Functional drink containing 1.0% extract

T_3= Functional drink containing 1.5% extract.

Chemical Analysis of functional drink

Total Soluble Solids, pH and acidity

The study was conducted to explore the effects of *L. royleana* seeds extracts on total soluble solids, pH and acidity value of the functional drink during storage period. From means, it is deduced that the maximum value for TSS in the functional drink sample was recorded in T_3 followed by T_2 as 11.43±0.73 and 11.37±0.54 respectively. However, the lowest recorded values were observed in T_0 as

11.19±0.65. Over the storage, it can be found that a gradual increase in the value for TSS was noticed that ranged from 11.20±0.46 to 11.18±0.75 and 11.29±0.44 at 15th, 30th and 45th day, respectively. However, the recorded values for the parameter were 11.36±0.52 at the termination of 60 days study as shown in the Table 6. Similarly, the maximum value for pH in functional drink sample is observed in T_1 as 4.02±.25. However, the values for T_3, T_2 and T_0 were 3.87±0.19 as given in Table 7. Over the storage, it can be found that there were non-significant value for pH was noticed that ranged from 3.81±0.19 to 3.97±0.19 and 3.88±0.19 at 15th and 45th days, respectively.

However, the recorded values for the parameter were 3.83±0.14 at the termination of 60 days study.

Table 9. Effect of treatments and storage days on TPC of functional drink.

Storage Days	Treatments				
	T_0	T_1	T_2	T_3	Mean
0	2.95±0.17^{n}	3.21±0.66^{j}	4.83±0.24^{e}	5.47±2.61^{a}	4.09±0.97^{a}
15	2.80±0.14^{n}	2.96±0.52^{k}	3.33±0.16^{f}	4.84±2.61^{b}	3.43±0.85^{b}
30	2.65±0.13^{n}	2.61±0.53^{k}	2.13±0.05^{g}	4.55±1.45^{c}	2.96±0.88^{c}
45	2.60±0.17^{n}	2.56±0.49^{l}	1.32±0.96^{h}	4.04±1.43^{d}	2.55±0.74^{d}
60	2.48±0.19^{n}	2.48±0.42^{m}	1.35±0.06^{i}	3.18±1.22^{e}	2.22±0.66^{e}
Mean	2.69±0.12^{d}	2.56±0.56^{c}	2.55±1.13^{b}	4.40±1.69^{a}	

Means ± Standard deviation

T_0= Normal Control

T_1= Functional drink containing 0.5% extract

T_2= Functional drink containing 1.0% extract

T_3= Functional drink containing 1.5% extract.

Likewise, from means, it is deduced that the acidity value was same in all the treatments as shown in Table 8. Over the storage, it can be found that there was no significant change in the value for acidity was noticed for T_2 that ranged from 0.35±0.01 to 0.38±0.01 at 0th and 45th days, respectively. However the recorded values for the parameter were 0.46±0.02 at the termination of 60 days study.

Total phenolic contents

It is evident from mean squares regarding total phenolic content of drink that significant variations were recorded for the effect of treatments and storage period as shown in Table 9. Means regarding TPC at the start of the study depicted that maximum mean was recorded in T_3 (5.47±0.61). However, the lowest recorded values were observed in T_0 (2.95±0.17). Over the storage, it can be found that a gradual decrease in the value for total phenolic content was noticed that varied from 4.09±0.97 and 2.55±0.74 at 15th and 45th days, respectively. However the recorded value for the parameter was 2.22±0.66 at the termination of 60 days study.

Amongst treatments, similar behavior was shown by all the treatments indicating significant decrease in the total phenolic content value during the course of storage.

The total phenolic content was noted for T_0 as it varied from 2.95±0.17 to 2.65±0.13 at 0 to 30th day, respectively. Moreover, with further developments in storage, recorded value for the trait was 2.48±0.19 at 60th day. Likewise, For T_1 and T_2, variations in the values differed from 3.21±0.66 and 4.83±0.24 to 2.51±0.24 and 2.13±1.05 at 0 to 30th days, respectively. Furthermore, the noted value for the parameters was 2.08±0.42 and 1.15±0.86 at the termination of 60 days study. The decrease in the total phenolic content value noticed for T_3 as it was 5.4±0.61 at initiation and was 3.18±0.22 at the termination of storage period.

Table 10. Effect of treatments and storage days on DPPH of functional drink.

Storage Days	Treatments				
	T_0	T_1	T_2	T_3	Mean
0	1.57 ± 0.03^{I}	2.36 ± 0.85^{def}	2.70 ± 0.03^{b}	3.40 ± 0.05^{a}	2.50 ± 0.04^{a}
15	1.34 ± 0.07^{I}	2.35 ± 0.08^{ef}	2.68 ± 0.01^{c}	3.36 ± 0.06^{bc}	2.43 ± 0.75^{b}
30	1.31 ± 0.06^{I}	2.32 ± 0.07^{g}	2.67 ± 0.07^{de}	3.34 ± 0.02^{cd}	2.41 ± 0.67^{c}
45	1.12 ± 0.07^{I}	2.32 ± 0.03^{gh}	2.66 ± 0.06^{f}	3.32 ± 0.09^{def}	2.35 ± 0.63^{d}
60	1.05 ± 0.04^{I}	2.31 ± 0.04^{h}	2.65 ± 0.68^{gh}	3.25 ± 0.07^{ef}	2.31 ± 0.59^{e}
Mean	1.27 ± 0.07d	2.33 ± 0.05^{d}	2.67 ± 0.04^{b}	3.34 ± 0.07^{a}	

Means ± Standard deviation

T_0= Normal Control

T_1= Functional drink containing 0.5% extract

T_2= Functional drink containing 1.0% extract

T_3= Functional drink containing 1.5% extract.

DPPH

Mean squares regarding DPPH value in Table 10 exhibit significant variations for the effect of treatments and storage period. From means, maximum value for DPPH in the functional drink sample was recorded in T_3 (3.34±0.97) followed by T_2 (2.67±0.84). However, the lowest recorded value was observed for T_0 (1.40±0.07). Over the storage, it can be found that a gradual decrease in the value for DPPH was noticed that decreased from 2.35±0.84 to 2.31±0.75 and 2.43±0.63 and 2.50±0.59 at 15th, 45th and 60th day, respectively. Amongst treatments, similar behavior was shown by all the treatments indicating significant decrease in DPPH value during the course of storage.

Table 11. Effect of treatments and storage on FRAP.

Storage Days	Treatments				
	T_0	T_1	T_2	T_3	Mean
0	2.18 ± 0.03^{l}	4.82 ± 0.06^{gh}	4.84 ± 0.06^{cd}	5.04 ± 0.01^{a}	to^{a}
15	2.14 ± 0.06^{l}	4.80 ± 0.03^{j}	4.72 ± 0.05^{de}	4.68 ± 0.97^{ab}	4.22 ± 0.08^{b}
30	2.11 ± 0.05^{l}	4.76 ± 0.45^{j}	4.62 ± 0.06^{ef}	4.50 ± 0.86^{bc}	4.29 ± 0.06^{c}
45	1.85 ± 0.04^{l}	4.68 ± 0.35^{k}	4.54 ± 0.07^{fg}	4.39 ± 0.05^{e}	4.16 ± 0.08^{d}
60	1.71 ± 0.03^{l}	4.60 ± 0.32^{k}	4.35 ± 0.05^{hi}	4.31 ± 0.03^{ef}	4.01 ± 0.05^{e}
Mean	1.99 ± 0.08^{d}	4.73 ± 0.03^{c}	4.61 ± 0.7^{b}	5.39 ± 0.84^{a}	

Means ± Standard deviation

T_0= Normal Control

T_1= Functional drink containing 0.5% extract

T_2= Functional drink containing 1.0% extract

T_3= Functional drink containing 1.5% extract.

The DPPH was noted for T_0 as it varied from 2.18±0.13 to 1.31±0.06 at 0 to 30th day, respectively. Moreover, with further developments in storage, recorded values for the trait were 1.57±0.04 at 60th day. Likewise, For T_1 and T_2, variations in the values differed from 2.31±0.85 and 2.65±0.71 to 2.32±1.23 to 2.67±0.05 at 0 and 30th days, respectively. Furthermore, the noted value for the parameter was 2.36±0.04 and 2.70±0.08 for T_1 and T_2 at the termination of 60 days study. The decrease in the DPPH value noticed for T_3 as it was 3.25±1.25 at initiation and was 3.40±0.87 at the termination of storage period.

FRAP

It is obvious from mean squares regarding FRAP value of drink that significant variations were recorded for the effect of treatments and storage period as shown in Table 11. Maximum value for FRAP in the functional drink sample was calculated in T_3 (5.04±0.08) followed by T_2 (4.84±0.07). Over the storage, it can be found that a gradual decrease was noticed for all the treatments that ranged from 4.22±0.06 to 4.16±0.02 and 4.01±0.46 at 0, 45th and 60th days, respectively. Amongst treatments, similar behavior was shown by all the treatments indicating significant decrease in FRAP value during the course of storage. The FRAP value was noted for T_0 as it varied from 2.18±0.13 to 2.11±.05 at 0 to 30th day, respectively. Moreover, with further developments in storage, recorded value for the trait was 1.71±.03 at 60th day. Likewise, For T_1 and T_2, variations in the values differed from 4.82±0.56 and 4.84±0.45 to 4.76±0.86 and 4.62±0.06 at 0 to 30th days, respectively. Furthermore, the noted value for the parameter was 4.6±0.03 and 4.35±0.05 at the termination of 60 days study. The decrease in the FRAP value noticed for T_3 as it was 5.04±1.1 at initiation and 4.31±0.73 at the termination of storage period.

Conclusion

Sweet basil is a renowned aromatic and medicinal plant, with a variety of newly revealed biological activities probably essential for immense ethnomedicinal applications. Amongst extraction methods, methanolic extraction proves to be preeminent one, contrary to ethanolic and n-hexane methods.Seed extract changed total phenolic content of drink significantly during storage period. Over the storage, a gradual decrease in the value for total phenolic content, DPPH and FRAP were observed. An increase in the TSS, pH and acidity of the functional drink was noticed during the storage. The studies made on the plant opened new way to research about the special effects of *Lallementia*.

References. AACC. **2000. Approved Methods of Analysis. Methods. St. Paul, MN, U.S.A: American Association of Cereal Chemists International.**

AOAC. 1990. Association of official, chemists, official methods of analysis. 15th Edition, Washington DC, U.S.A. ai medicinal plant. International Journal of Systematic and Evolutionary Microbiology **58,** 2439-2442.

Bozin B, Mimica-Dukic N, Simin N, Anackov G. 2006. Characterization of the volatile composition of essential oils of some Lamiaceae spices and the antimicrobial and antioxidant activities of the entire oils. Journal of agricultural and food chemistry **54(5),** 1822-1828.

El-Beshbishy H, Bahashwan S. 2012. Hypoglycemic effect of basil (Ocimum basilicum) aqueous extract is mediated through inhibition of α-glucosidase and α-amylase activities: an in vitro study. Toxicology and Industrial Health **28(1),** 42-50.

Fatima J, Mansoor S, Saadia MA, Rehman M, Mustafa H. 2016. Phyto-Chemical Analysis, In-Vitro Antioxidant Potential and GC-MS of Lallemantia royleana Seeds. International Journal of Scientific and Research Publications **6(2).**

Hegde K, Joshi AB. 2010. Hepatoprotective and anti-oxidant effect of Carissa spinarum root extract against CCl4 and paracetamol-induced hepatic damage in rats. *Bangladesh* Journal of Pharmacology **5(1),** 73-76.

Hinneburg I, Dorman HD, Hiltunen R. 2006. Antioxidant activities of extracts from selected culinary herbs and spices. Food chemistry **97(1),** 122-129.

Latimer GW. 2012. Official methods of analysis of American Association of Cereal Chemists International.

Mahmood S, Hayat MQ, Sadiq A, Ishtiaq S, Malik S, Ashraf M. 2013. Antibacterial activity of Lallemantia royleana (Benth.) indigenous to Pakistan. African journal of microbiology research **7(31),** 4006-4009.

Mir MA, Sawhney S, Jassal M. 2013. Qualitative and quantitative analysis of phytochemicals of Taraxacum officinale. Wudpecker Journal of Pharmacy and Pharmocology **2(1),** 1-5.

Moghaddam TM, Razavi SM, Emadzadeh B. 2011. Rheological interactions between Lallemantia royleana seed extract and selected food hydrocolloids. Journal of the Science of Food and Agriculture**91**(6), 1083-1088.

Muller FL, Lustgarten MS, Jang Y, Richardson A, Van Remmen H. 2007. Trends in oxidative aging theories. Free Radical Biology and Medicine **43(4),** 477-503.

Nurzynska-Wierdak R, Borowski B, Dzida K, Zawislak G, Kowalski R. 2013. Essential oil composition of sweet basil cultivars as affected by nitrogen and potassium fertilization. Turkish Journal of Agriculture and Forestry **37(4),** 427-436.

Pirani A, Moazzeni H, Mirinejad S, Naghibi F, Mosaddegh M. 2011. Ethnobotany of Juniperus excelsa M. Bieb.(Cupressaceae) in Iran. Ethnobotany Research and Applications **9,** 335-341.

Prashant T, Bimlesh K, Mandeep K, Gurpreet K, Harleen K. 2011. Phytochemical screening and extraction: A review. Internationale Pharmaceutica Sciencia **1(1),** 98-106.

Rafe A, Razavi SM, Farhoosh R. 2013. Rheology and microstructure of basil seed gum and β-lactoglobulin mixed gels. Food Hydrocolloids **30(1),** 134-142.

Razavi SM, Mortazavi SA, Matia-Merino L, Hosseini-Parvar SH, Motamedzadegan A, Khanipour E. 2009. Optimisation study of gum extraction from Basil seeds (Ocimum basilicum L.). International journal of food Science & Technology **44(9),** 1755-1762.

Razavi SMA, Moghaddam TM, Amini AM. 2008**.** Physical-mechanical properties and chemical composition of Balangu (Lallemantia royleana (Benth. in Walla.) seed. International journal of food engineering **4(5).**

Shweta M, Akanksha B, Nayyar P, Pramod K. 2016. Extraction and use of lallemantia royleana seed mucilage as a pharmaceutical excipient. World Journal of Pharmaceutical Research **4(4),** 1578-1589.

Singleton VL, Orthofer R, Lamuela-Raventós RM. 1999. Analysis of total phenols and other oxidation substrates and antioxidants by means of folin-ciocalteu reagent Methods in enzymology **299,** p 152-178.

Steel RGD, Torrie JH. 1997. Principles and procedures of statistics, a biometrical approach: McGraw-Hill Kogakusha, Ltd.

Sun C Fu J, Chen J, Jiang L, Pan Y. 2010. On-line HPLC method for screening of antioxidants against superoxide anion radical from complex mixtures. Journal of separation science **33(8),** 1018-1023.

Taga MS, Miller E, Pratt D. 1984. Chia seeds as a source of natural lipid antioxidants. Journal of the American Oil Chemists' Society **61(5),** 928-931.

Wangcharoen W, Morasuk W. 2007. Antioxidant capacity and phenolic content of holy basil. Songklanakarin Journal of Science and Technology **29(5),** 1407-1415.

Yuan F, Quataert E, Narayan R. 2003. Nonthermal electrons in radiatively inefficient accretion flow models of Sagittarius A. The Astrophysical Journal **59(1),** 301.