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Compound identification of Damask rose: an insight to petal and its extraction

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Abstract

Damask rose (Rosa damascene M). is one of the most important aromatic plants in the world. The objective of this study is to determine the composition and quality characteristics of dried Damask rose petals (DDRP) growing in Syrian conditions. Proximate components, microbial, chemical and physical properties of DDRP and its extracts were determined according to the standard methods. The results showed that DDRP have high total carbohydrate (75.21%), and crude protein (9.80%), and ash (3.88%) as source of micro, macro and trace elements, but low crude fat (0.96%), and moisture (7.20%). The initial total viable count (TVC) and total mould and yeast (TMY) were 2.29 and 2.10 log cfu-1, respectively. However, the properties of the DDRP extraction were determined to be; Total soluble solids (TSS) 1.77%, total acidity (TA) (0.77%), pH value (5.06), total volatile basic nitrogen (TVBN) (6.11 ppm), and viscosity (21.67 mP.Sc). The composition of DDRP and its extract are fulfilled in the recommended levels on national and international standards.

Keywords: Damask rose, Microbial load, Chemical properties, Composition

Introduction

Edible flowers have been used traditionally to improve the taste and value of foodstuffs. The first reports of flower consumption as a human food and medical product are from Ancient Rome [1]. The flower consumption as food or medicine increase is related to the change in the nutrition habit that are more aware of the food quality. Today, the edible flowers, are traditionally consumed in different area on the world [2]. At present, traditional medicine is more acceptable than in the past, because, it is cheaper and more accessible than conventional treatment [3]. Edible flowers contain minerals amino acids, vitamins, phenolics, terpenoids, carotenoids, coumarines, curcumins flavonols, anthocyanins, and other phytochemical compounds that act as antimicrobial antioxidant, anti-inflammatory, anticancer, anti-obesity and neuroprotective effects [4,5].

The genus Rosa contains more than 200 species distributed in Asia, Europe, Middle East, and North America. Rosa damascena Mill is commonly known as Damask rose (DR) or oil-bearing rose from Rosaceae family is one of the most important floricultural crop and famous medicinal plant which is one of the most important aromatic plants throughout the world [6]. DR labelled as Gol-E-Muhammadi (the flower of Prophet 'Mohammad') by the people of Iran [7]. Indeed, DR has been a popular medicinal plant through the history [8]. The United Nations Educational, Scientific and Cultural Organization (UNESCO) has inscribed DR and associated heritage practices on the UNESCO Intangible Cultural Heritage of Humanity list [9].

DR is used as an ornamental plant in gardens and parks, but its widely cultivated for it's essential oil, medicinal properties, and food industry aspects in many areas of the world [10]. They can also be used as food additives, in perfumery, cosmetics and pharmaceutical industries [11]. Several medical benefits of the genus Rosa have been indicated in many publications and specific part of the plant have been used for different purposes [12], and their essential oils are used for cosmetics and aromatherapy. The average oil content in the DR flowers is 0.035%, but varies among varieties from 0.009% to 0.062% [13]. Because of the low oil

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content in DR, essential rose oil of this plant is one of the most expensive ones in the world markets [14]. DR essential oil is well known in the perfume industry, which is a product of the hydrodistillation method, and has been traditionally used in aromatherapy to manage anxiety and sleep problems [15].

A literature survey revealed that, the lack of knowledge about the DR produced in Syria. Therefore, the present study provides information on various parameters including the chemical composition, microbial and physico-chemical properties of DDRP, growing in the Syrian conditions; comparing of the obtained results with composition of DDRP standardized in national and international standard in order to validate their quality.

2. Materials and methods

2.1. Treatments and analysis performed

This research is an experimental laboratory study with data collection (random sampling) using samples of dried Damask Rose petals (DDRP). The study was conducted in 2019 at the Radiation Technology Department, Syrian Atomic Energy Commission. The sample used was a DDRP obtained from the organic herb trading company in Damascus, Syria and mixed for packaging in polyethylene plastic bags (150 g /bags).

2.2. Extraction yield

To obtain extracts from the commercially DDRP, 20 ml of distilled water was added to DDRP of 5 g from each sample and mixed for 20 minutes. The suspension was made up to 200 ml with hot distilled water (75°C) and mixed for 3 h. The total soluble solids (TSS) were determined in the extracts by using Abbe Refractometer, VEB Carl Zeiss JENA. DDR (0-100) range, according to the standard methods [16].

2.3. Chemical analysis

Moisture (by drying for 6 h at 105 ^{o}C), crude protein (using micro-Kjeldahl method), crude fat (as extractable component in Soxhlet apparatus), and ash contents (by ashing for 4 h at 550 ^{o}C) were determined according to the method described in the Association of Official Analytical Chemists [16]. Total carbohydrate was estimated using Anthrone indicator method by measuring the absorbance at 620 nm with a T70 UV/VIS Spectrophotometer, (PG Instrument Ltd).

The reducing sugars were estimated by iodometric determination of the unreduced copper remaining after reaction, and the concentration of reducing sugars were expressed as g glucose/ 100 g DDRP [16]. The total acidity (TA) was determined by a direct titration with (0.1 N) NaOH and indexed as ml of (0.1 N) NaOH = 0.0090 g lactic acid (AOAC, 2010). The pH values of the DDRP extracts at 28°C were determined using an HI 8521 pH meter (Hanna Instruments, Woonsocket, RI, USA). Total volatile basic nitrogen (VBA) was determined in the sample in terms of mg VBN/kg DDRP (ppm) [17]. Samples were analyzed in triplicates. Minerals content including: major elements (Potassium (K), Magnesium (Mg), Chlorine (Cl), Sodium (Na) and Calcium (Ca)); trace elements (Aluminum (Al), Bromine (Br), Cobalt (Co), Iron (Fe), Manganese (Mn), Rubidium (Rb), Zinc (Zn), Barium (Ba), cupper (Cu) and Cerium (Ce)); and toxic elements (Chromium (Cr), Arsenic (As), Lanthanum (La), Selenium (Se), Strontium (Sr), and Vandium (V)) were determined in DDRP samples using Instrumental Neutron Activation Analysis (INAA) according to the standards methods descript by Al-Bachir et al. [18].

2.4. Physical analysis

The viscosity of the suspensions of DDRP was measured with viscosity meter Model (RTM) Townson+Mercer 061 928 6211, using U column (Instrument No. 5769) and fixed No. 0.027171. Viscosity values were determined and expressed as mPa/s [19]. The color of DDRP extract was measured using AvaSpec Spectrometer Version 1, 2 June 2003 (Avantes, Holland) at wave length of 670 nm by exposing the samples to the illuminant A light source and the CIE L (lightness), a (redness), and b (yellowness) values were obtained on the basis of L*, a*, b* and the color difference (ΔE*) values, where L value indicates the lightness, a value gives the degree of the red-green color, The b value indicates the degree of the yellow-blue color [19].

2.5. Microbiological analysis

Three replicates from DDRP were aseptically opened, and 10 g of whole DDRP were transferred to prepare serial dilutions according to standard methods [16]. Total viable counts (TVC) were determined by using plat count agar (PCA) (Oxoid, CM 325, UK) (30 °C, 48 h). Total coliform counts (TCC) were determined using Violet Red Bile Agar (VRBA) (Oxoid, CM 485, UK) (37 °C, 48 h).

Total mould and yeast (TMY) were determined using Dichloran Rose-Bengal Chloramphenicol Agar (DRBC) (Merck, 1.00466, Germany) (25 °C, 5 days). Microbial counts were transformed to log 10 cfu /g.

2.6. Statistical analysis

The experiment consisted of two storage periods in a completely randomized design with three replicates. The data were subjected to the analysis of variance (ANOVA) and reported as the means ± standard deviation (SD). An analysis of variance with a significance level of 5% was done and Duncan's test applied to determine differences between means using the commercial statistical package (SPSS, Inc, Chicago, IL, USA) using the statview 4 computer package.

3. Results and discussion

3.1. Proximate composition of DDRP

The proximate chemical composition of DDRP is shown in Table 1. The contents of moisture, crude protein, crude lipid, ash, total carbohydrate, and reducing sugar were: 7.20 ± 0.08, 9.80 ± 0.09, 0.96 ± 0.03, 3.88 ± 0.02, 75.21 ± 2.60, and 3.55 ± 0.30%, respectively. The whole DDRP moisture contents were quite low (7.20%). The low moisture level of the product samples could store for longer time without spoilage, since moisture content of plant materials determines their susceptibility to spoilage by microorganisms. Moisture content is correlated to shelf life and its final quality of products. High moisture content can cause fungal growth, and thus introduces a high risk of aflatoxin production [20]. Whereas, low moisture content can accelerate pigment degradation and color loss [21]. Food with moisture content higher than 13% is susceptible to decomposition by microorganisms [22].

Based on these results, it was verified that DDRP showed high levels of protein (9.80%), and should be considered as good protein sources to achieve nutritional needs since they are of high biological value [23].

In the characterization of DDRP, the total carbohydrate were the highest amount (75.21 %). DDRP can be characterized as a source of fiber according to the national and international recommendation for a food to be characterized as a source of fiber [24].

Ash content is a reflection of the number of mineral elements in the plant samples and therefore serves as the main source of mineral elements needed for human health. A value of 3.88% obtained for ash content of DDRP is high. Aremu and Akinwumi [25]. recommended that ash content of plants should fall in the range 1.5 – 2.5% in order to be suitable for human consumption. In general, the flowers have low fat content and different levels of carbohydrates, proteins and minerals [26]. These results mean that DDRP had high total carbohydrateand mineral contents but low-fat contents. The quality or nutritive value of any plant food for human nutrition, depends on its basic constituents, including proteins, carbohydrates, fat and minerals [27]. Therefore, DDRP have importance from the point of dietary components which is related to the intestinal regulation. De Lima Franzen et al. [24] evaluated the fruit proteins, lipids, carbohydrates, fiber and ash, values that are similar to those found in flower petals, showing that nutritionally, edible flowers are similar to some fruits and even comparable to other conventional vegetables.

The total carbohydratecontents were found to be depleted by storage in DDRP samples, whereas, the moisture, crude protein, crude fat, and reducing content were increased due to the decreasing of protein and carbohydrate. This could be due to the difference in the extent of water hydrolysis by storage [28]. Also, the increase in water content and the decrease in carbohydratecontent in stored DDRP could be attributed to the stimulatory effect of storage on some metabolic processes involving the conversion of carbohydrateinto water [27]. The decrease in total carbohydrateon storage has been attributed to de-polymerization and de-lignification of the plant matrix [29].

Table 1. Effect of storage period on moisture, crude protein, crude fat, ash, total carbohydrate, and reducing sugar contents (%) of dried Damask Rosa Petal (DDRP)

Storage period /(Months)	**0**	**12**	**P-level**
Characteristics			
Moisture (%)	7.20±0.08^{b}	10.38±0.02^{a}	**
Crude protein (%)	9.80±0.09^{b}	11.46±0.24^{a}	**
Crude fat (%)	0.96±0.03^{b}	1.04±0.00^{a}	**
Ash (%)	3.88±0.02^{a}	3.86±0.05^{a}	**NS**
Total carbohydrate (%)	75.21±2.60^{a}	72.09±0.88^{a}	**NS**
Reducing sugar (%)	3.55±0.30^{b}	5.32±0.13^{a}	**

^{abc} Means values in the same row not sharing a superscript are significantly different.
NS: not significant; * Significant at p<0.05; ** Significant at p<0.01.

3.2. Minerals composition of DDRP

The NAA analytical technique allowed us to obtain the concentration of 21 elements in DDRP. The major elements (K, Mg, Cl, Na and Ca), trace elements (Al, Br, Co, Fe, Mn, Rb, Zn, Ba, Cu, and Ce), and toxic elements (Cr, AS, La, Sc, Sr and V) were detected in DDRP samples, and obtained results are found in Table 2. The mineral content reflects that a good contribution to the product like syrup can be made if DDRP are used in preparation of such products. The results in this study related to DDRP could only be compared with the reports on rose hip fruits or its products, since almost no detailed studies on the chemical composition of DDRP have been reported. Rop et al. [30], reported the content of K, P, Ca, Mg, Fe, Cu and Zn as 196.9 mg/100g, 22.5 mg/100g, 27.5 mg/100g, 0.35 mg/100g, 0.23 mg/100g and 0.45 mg/100g, respectively for the variety Rosa odorata. However, Kumar et al. [31] reported that the fresh petals had 153.39 mg of K, 34.53 mg of P, 13.78 mg of Ca, 1.82 mg of Cu, 1.33 mg of Fe and 0.29 mg of Zn per 100 g.

An overall average concentration of Potassium (K) in DDRP is (4878 mg/kg). The K contents in the fruits of DR were reported to be 10256.0 ± 84.2 mg/kg by Kazaz et al. [32] and 4200–11 900 ppm in various rose species by Kovacs et al. [33]. Also, the K contents in the rose petals jam were reported to be 977.89–3341.59 ppm in various kinds of rose jam by Hanan and Rasha [34].

Magnesium (Mg) contents in the DDRP (1598±502 mg/kg) were close to the findings of Kazaz et al. [32], and Kovacs et al. [33], who reported that the Mg contents in the damask rose fruits and fruit parts (441–1501 mg/kg and 965–2175 mg/kg respectively. Whereas, Hanan and Rasha [34] reported it in rose petals jam as 279.38 – 375.40.

Mg is an important mineral element in connection with circulatory disease such as ischemic heart disease [35].

Sodium (Na) contents in DDRP was 19.31±0.60 mg/kg. Na content of DDRP was found to be lower than that given by Kazaz et al. [32]. Hanan and Rasha [34] reported it in rose petals jam as 280.00 – 397.42.

Calcium (Ca) contents of DDRP were found 1557±199 mg/kg. Kazaz et al. [32] (2009) reported the Ca contents of DR and rose hip fruits and fruit parts were found between 3885–11 162 mg/kg and 3800–8442 mg/kg, respectively, whereas Ercisli [36] reported it as 2867 ppm, and Hanan and Rasha [34] reported it in rose petals jam as 268.87 – 365.87.

The iron (Fe) contents in the DDRP was determined to be 79.0±4.0 mg/kg in this study. The Fe content in the DDRP was very similar to that given by Ercisli [36], and Kazaz et al. [32]. Also, the Fe content in rose hip seeds was close to the result of Szentmihályi et al. [37] which was 20.15 ppm. However, Hanan and Rasha [34] reported it in rose petals jam as 15.08 – 70.10.

Manganese (Mn) contents were determined as 37.2±6.3 mg/kg. The findings of this study, regarding the Mn content in the DDRP were higher than those (24.24 mg/kg) and (3.32–7.07 ppm) reported by Kazaz et al. [32] and Hanan and Rasha [34] respectively, whereas Ercisli [36] reported it as 2867 ppm, Mn is a microelement essential for human nutrient; it acts as activator of many enzymes [38].

The zinc (Zn) contents in the DDRP was found to be 26.8±0.6 mg/kg. The results obtained in the present study on the Zn was higher than those of Kazaz et al. [32], Ercisli [36], Szentmihályi et al. [37], and Hanan and Rasha [34] which give the value of 4–14 ppm. Zn is involved in normal immune system.

Copper (Cu) contents were determined to be 11.42±2.42 mg/kg with DDRP. The Cu contents obtained from the flowers of DDR in this study was found to be higher than (4 mg/kg) that given by Kazaz et al. [32] and Szentmihályi et al. [37]. Our results were in accordance with the data of Ercisli [36]. Cu is an essential trace element in human body and exist as an integral part of Cu protein cerulosmin, which is concerned with the release of iron from the cell to the plasma and is involved in energy metabolism [35].

Crome (Cr) contents were determined to be 0.24±0.02 mg/kg with DDRP. Cr in trivalent state is an essential trace element that potentiates insulin action and those influences carbohydrate, lipid and protein metabolism [39].

An overall average concentration of (Cl) (380 mg/kg) as major elements; (Al) (65.98 mg/kg), (Br) (1.22 mg/kg), (Co) (0.45 mg/kg), (Rb) (6.63 mg/kg), and (Se) 0.06 mg/kg) as trace elements; and (As) (0.04 mg/kg), (La) (0.04 mg/kg), (Sc) (6.10 mg/kg), (Sr) (15.63 mg/kg), and (V) (0.13 mg/kg) as toxic elements (Table 2).

Table 2. Elements concentrations (µg/g) of dried Damask Rosa Petal (DDRP)

	Concentrations (µg/g)
Major elements	
K	14850±502
Mg	1598±65
Cl	380±15
Na	19.31±0.60
Ca	1557±199
Trace elements	
Al	65.98±5.58
Br	1.22±0.04
Co	0.45±0.01
Fe	79.0±4.0
Mn	37.2±6.3
Rb	6.63±0.38
Zn	26.8±0.6
Ba	3.09±0.31
Cu	11.42±2.34
Ce	0.09±0.02
Toxic elements	
Cr	0.24±0.02
As	0.03±0.01
La	0.04±0.01
Sc	0.0231±0.004
Sr	15.63±4.20
V	0.13±0.05

3.3. Color of DDRP

As Shows in Table 3, color estimation of DDRP revealed L* (lightness) value of 43.36, a* (redness) value of 26.20, b* (yellowness) value of -25.27, and ΔE value 35.97. L* value of 43.36 revealed that the rose variety used in this study was rich in pigments. Positive a* value indicates the redness of color while the negative b* value is an indication of blue color. The intensity of blue and red color might have been due to the presence of the flavonoid class of anthocyanins with other flavonoid compounds acting as co-pigments [19].

It could be noticed that the highest L* value of 53.54, a* value of 17.25 and b* value of -0.6. L* value of 53.54 were given by Rose variety produced in India [31]. There is no information available in the literature on the color of DDRP produced in Syria and on the effect of storage on the color of DDRP. However, color is considered one of the most important factors for a consumer's acceptance or rejection of food products. Therefore, the color value is considered as a quality index for its measurement and is frequently used as an indicator of the overall quality level of the final product [40].

In general, storage increased significantly ($p>0.05$) the L*, a*, and ΔE values of DDRP. After 12 months of storage the L*, a* and b*, and ΔE value were 60.44, 30.35, -25.61 and 36.97 respectively. However, for the other plant materials, diverse effects of storage on the color of its extract have been reported [41].

Table 3. Effect of storage period on color change of dried Damask Rosa Petal (DDRP)

Storage period /(Months)	**0**	**12**	**P-level**
Color changes			
L* (Lightness)	43.36±0.88^{b}	60.44±4.28^{a}	**
a* (redness/greenness)	26.20±1.81^{a}	30.35±2.00^{a}	*
b* (yellowness/blueness)	-25.27±3.47^{a}	-25.61±2.71^{a}	NS
ΔE (Total color difference)	35.97±3.15^{a}	36.15±0.99^{a}	**

^{abc} Means values in the same row not sharing a superscript are significantly different.
NS: not significant; * Significant at $p<0.05$; ** Significant at $p<0.01$.

3.4. Microbial qualities of DDRP

The DDRP exhibited rather high microbiological contamination; the initial contamination load of DDRP samples including total viable count (TVC), and total mold and yeast count (TMYC) were 2.92 ±0.04, and 2.10 ± 0.17 log cfu/g, respectively (Table, 4). During storage at ambient temperature, the TVC, and TMYC of DDRP increased significantly ($p>0.05$). After 12 months of storage the TVC and TMYC of DDRP were 3.32 and 2.67 log cfu/g respectively. Heavy TVC and TMYC was visible after 12 months of storage. Therefore, ambient temperature storage is not suitable for shelf-life extension of DDRP.

The total aerobic plate counts that have been reported for other botanical raw materials ranged between 3 and 8 log cfu/g [42,43].

However, it was described that the microorganisms contamination of dried herbal material is not so much caused by secondary contamination during processing, but may mainly be due to the fact that plants have their specific microbial flora [44].

The good agricultural practices (GAP) and good manufacturing practices (GMP) applied in the production and processing of the analyzed plant products could explain the low microorganisms loads obtained. However, to fulfill the requirements of health and food industries regarding raw materials, lower microorganisms' loads must be attained [43].

Flower consumption should follow hygiene and food safety rules during production, processing, storage, distribution and sale [45].

Dehydration is done by keeping the petals in a shady place, taking about one week and allowing preservation for prolonged periods [46].

Table 4. Effect of storage period on total bacterial (log10cfu.g) and fungal (log10spores.g) count of dried Damask Rosa Petal (DDRP)

Storage period /(Months)	**0**	**12**	**P-level**
Characteristics			
Total viable count (log^{10} cfu.g)	2.92±0.04^{b}	3.32±0.06^{a}	**
Total mould and yeast count (log^{10} spores.g)	2.10±0.17^{b}	2.67±0.04^{a}	**
Total coliform (log^{10} cfu.g)	ND	ND	

^{abc} Means values in the same row not sharing a superscript are significantly different.
NS: not significant; * Significant at $p<0.05$; ** Significant at $p<0.01$; ND: Not Detected.

3.5. Chemical and physical properties of the DDRP extracts

3.5.1. Total solved solids (TSS) in DDRP extracts. Extract yields from DDRP in distilled water were determined and given in Table 5, The extract from DDRP gave a yield of 1.77 %. The higher total dissolved solids in extract of DDRP might have been due to richness of rose flowers in the phytochemicals [47]. The yield of DDRP has not been investigated. However, earlier research studies showed that the extraction yield of medical plant ranged from 9 to 18% [19,48,49]. The differences in extraction yield; as compared to that reported in the literatures may be due to different chemical composition of the plants and extraction methods that used [50] (Khattak et al., 2008).

The yield of DDRP extraction was significantly ($p< 0.05$) decreased with storage. After 12 months of storage, the total soluble solids were 1.90%. This could be attributed to the change of dry matter content during storage and polysaccharide de-polymerization of the plant [51].

3.5.2. Total acidity and pH values of DDRP extract. The total acidity (TA) of DDRP extract in term of % lactic acid as affected by storage time is presented in Table 5. The TA content of DDRP extract was found to be 0.77% at the beginning of storage. The results revealed that the TA in DDRP extract decreased significantly ($p \leqslant 0.05$) with an increase in the storage period. After 12 months of storage, the TA content of DDRP decreased to 0.40%. Given the low moisture content (7.20%) of DDRP, it is most probable that negligible amount of free fatty acids (FFA) were produced through triglycerides hydrolyses [17]. The DDRP extract sample was found to have pH 5.06. The pH value of DDRP increases with the increase of storage periods. However, after 12 months of storage the pH value of DDRP was 5.67. Such data are in good agreement with Ercisli et al. [36], and Seker and Toplu [52]. Hanan and Rasha [34] who reported that the pH values of rose petals jam ranged from 4.8 to 6.3.

3.5.3. Total volatile basic nitrogen (TVBN) of DDRP. The effect of storage time on TNBV content of DDRP is shown in Table 5. Storage time caused significant ($p<0.05$) difference between the TVBN composition of the DDRP. The TVBN value, which is regarded as one of the standard chemical indices of freshness of protein component was assessed because the DDRP contained protein as the major component. The TVBN is related to protein breakdown and the increases of TVBN may be due to the production of ammonia or other basic compounds due to microbial activity [17]. The high TVBN content in the DDRP (6.11 ppm) was determined to be due to hydrolysis caused by interactions between amygdalin and emulsin resulting from the destruction of the seed cell wall after grinding of the samples [53]. The TVBN of DDRP samples increased significantly ($p<0.05$) during storage. . After 12 months of storage, the TVBN of DDRP increased up to 10.04 ppm. The increase in TVBN in stored DDRP may be attributed to the formation of oxidation or degradation products [54].

3.5.4. Viscosity of the DDRP extraction. The viscosity of DDRP extraction in water was determined and is shown in Table 5. The viscosity of DDRP extraction was 21.67 mP.Sc. Storage had a significant effect on viscosity. After 12 months of storage, the viscosity of DDRP extraction was 24.33 mP.Sc. There is no information available in the literature on the viscosity of the DDRP extraction and on the effect of storage on viscosity of DDRP extraction. However, several researches have been done for other plant materials, and in studying the determination of the viscosity of its extraction. A research study conducted by Al-Bachir and Al-Adawi [45] indicated that the viscosity of licorice root extracts was (19.00 mPa.S). Al-Bachir [19] reported that the viscosity of chamomile extracts was (60.00 mPa.S). The differences in the viscosity between extracts produced from different kind of plants may be attributed to the degradation of some high molecular weight components, and changing these components from non-soluble to soluble ones in the test solvents or may be due to different chemical composition of plants [55].

Table 5. Effect of storage period on total acidity (% Lactic acid), PH value, volatile basic nitrogen (VBN)(P.P.M), total soluble solid (oBrix) and viscosity (mP.Sc) of .Rosa Damascena

Storage period /(Months)	**0**	**12**	**P-level**
Characteristics			
Total soluble solid (ºBrix)	1.77±0.15[a]	1.90±0.10[a]	**NS**
Total acidity (% Lactic acid)	0.77±0.03[a]	0.40±0.02[b]	**
PH value	5.06±0.03[b]	5.67±0.10[a]	**
Volatile basic nitrogen (ppm)	6.11±0.62[b]	10.04±0.00[a]	**
Viscosity (mP.Sc)	21.67±0.58[a]	24.33±0.58[b]	**

4. Conclusion

The DR. R. damascena is one of the most important species of Rosaceae family mainly known for its perfuming. Its major products are rose water and essential oil.

In conclusion, the DDRP produced under Syrian conditions had higher total carbohydrate, crude protein, macro, micro and trace elements, but lower crude fat contents. Therefore, DDRP having importance from the point of dietary component which is related to the health regulations, and proved to be nutritious functional and healthful foods.

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Compliance with Ethics Requirements: Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human or animal subjects (if exist) respect the specific regulation and standards.

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