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Dates Utilization to Process Some New Dietary Products (Marshmallow and Sheets) and Their Acceptability Evaluation

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Abstract

Background and Objective: Date fruits are an imperative crop, especially cultivated in the hot-arid regions of the world having extraordinary nutritional and therapeutic value. Also, marshmallow is a confection of foam-like structure and demand for it is constantly growing on the world market. This study is performed to investigate the possibility of producing new dietary products called dates marshmallow and sheets with a new technology. **Materials and Methods:** Mixing the juice of dates with fruit juice such as golden berry and *Tamarindus indica* with ratio 50% led to reduce the content of sucrose and total sugars. **Results:** Total phenolic compounds for dates, 50%; *Tamarindus indica*, 50% were the highest one. Flavonoids were the highest value in samples dates (100%) followed by the other. It noticed that, carotenoids recorded the highest content in all samples. Objective testing color measurements, all treatments including both of controls were observed less in yellowness (***) value. On the other hand, fibers, total acidity and vitamin C were close and almost compatible with the control. It could be clearly observed that, treatment of date sheets product (zero time) were more in compared with control by increasing time of storage. **Conclusion:** Second degree types of dates are proper, successful, economic and applicable to produce as a new product marshmallows as well as it can be made in sheets form by heat concentrated drying which it gave an added value for dates that was very well for consumer palatability in general by sensory evaluation.

Key words: Dietary products, golden berry, *Tamarindus indica*, gelatin, pectin, marshmallow

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Dates fruits are an extremely famous and oldest food known to human beings and it has been proven to contain high levels of carbohydrate, proteins, vitamins, crude fibers and essential minerals. Therefore, dates not only delicious with sweet taste and a fleshy mouth feel but also considered as an almost ideal food that provides a wide range of essential nutrients with many potential health benefits¹.

It is well established that dates are rich in sugars (fructose, glucose and sucrose), minerals (potassium, calcium, magnesium, phosphorous and manganese), vitamins (particularly A and D) and natural fibers^{2,3}. Dates are rich in carotenoids, polyphenols and sterols. They have been used in folk medicine for treatment of various ailments⁴⁻⁷.

Kalifa⁸ reported that, the date crop in Egypt is considered a strategic crop and currently occupies the first place in date production at the world level before Iran and Saudi Arabia. The annual production is estimated at 1.465.030 t with 17.7% of the world production estimated at 7.5 Mt. The local varieties increased by 15.6%, in addition to the thousands that were introduced and represent a development of the sector.

Date is among the fruits that is characterized by high caloric value as one kg of dates contains around 3000 calories. Carbohydrates represent most of the chemical constitution of date (70%). Beside carbohydrates, date also contains proteins, fats, fibers, vitamins and mineral. Moisture content of dates ranged between 15-30% depending on different factors related to variety and maturity stage⁹.

Date fruit sheets (also called slaps) are made by drying thin layers of pureed fruit in the oven or dehydrator¹⁰. The sheets are characterized with their relative light weight therefore afford convenience in storage and handling. In addition the dehydration process decrease the moisture content of date sheets which lead to suppression of microbial growth and enhancement of the shelf life. In order to reconstitute date sheets into a date beverage, 1 part of the sheets is immersed in 5 parts of water with continuous stirring. Nutritional food values become concentrated in dried fruit and so do calories. Since moisture is removed, the residue is concentrated. They dehydrated fruit-based products eaten as candy or snacks and presented as flexible stripes or sheets. Due to its novel and attractive structure and for being products that do not require refrigeration, they constitute a practical way to incorporate fruit solids, especially for children and adolescents⁹.

Candy is one of favourite foods among people from a wide range of age. Confectionery products are food formulations made of aqueous dispersions of sugar syrups and are available in a broad variety of forms^{11,12}.

Marshmallow is sugar-candy with foam-like structure. Many studies have revealed the high nutritional value of bee pollen. According to the nutritional composition of pollen, dried bee pollen has been used as an additive in human diets, which provides a well-being sensation and contributes to functional and harmonious balance of the body. Important part of developing a new product depends on sensory evaluation and market research¹¹.

Thus, the aim of this study was to evaluate the production of high quality natural marshmallow and sheets dates as new products for an added value for second degree types of dates. Value addition is another important segment in the date consumption pattern in the world. These value added products are highly viable commercially. It is also extended to study the possibility of production of restructure by using pectin in processed sheets.

MATERIALS AND METHODS

This study carried out in our pilot of food technology Research Institute, Agricultural Research Center, Giza, Egypt.

The study was conducted during the month of July until December, 2018.

Materials: Dates, semi dry variety, were purchased from a culture near Giza Governorate (Gamar El-Dyne) or Commercial Apricot sheets and artificial marshmallows were purchased from a local market in Giza Governorate.

Methods

Preparation of each natural extracts: Semi dry dates were washed and squeeze, then prepared as puree mixed with hand blender.

Preparation of natural marshmallow: The producing recipe contains the following ingredients: Golden berry juice (50%)/ *Tamarindus indica* soaked (50%)/semi-dry dates puree (100%) of main total (100 mL), coarse sugar (360 g), golden syrup (140 g), gelatin (25 g), vanilla, confectioners (powdered) sugar and corn starch or (corn flour).

Process and preparation of sheet products: The producing recipe contains the following ingredients: Dates puree (500 mL), pectin (200 g) and sugar (15 g) by using heat-concentrated drying.

Main physical parameters and chemical composition of marshmallow (soft candies): The physicochemical analysis of samples were analyzed according to standards of AOAC¹³. The method for determination of moisture content, crude fiber, total sugars/reducing sugars contents, total acidity (as citric acid), vitamin C and sucrose.

Tristimulus color measurement: Visual color was measured using a Hunter colorimeter model Color Flex (Hunter Associates Laboratory, Reston, VA) in terms of L (lightness), a (redness and greenness) and b (yellowness and blueness). The instrument (45°/0° geometry, 10° observer) was calibrated with a standard black and white tile followed by measurement of samples¹⁴.

Phenols: Phenols were determined according to Maier and Metzler¹⁵ method.

Phenols compound as gallic: Phenols compound as gallic were determined according to Boligon *et al.*¹⁶.

Flavonoids: Flavonoids were determined according to Chen and Li¹⁷.

Carotenoids as (β-carotene): Carotenoids as (β-carotene) were determined according to Nagata and Yamashita¹⁸.

Physical properties: Textural Attributes such as texture profile parameters (hardness, cohesiveness, springiness, gumminess and chewiness).

Texture profile analysis test of samples (which shape was 3×3×3 cylindrical) was done using a Universal Testing Machine (TMS-Pro) Food Technology Corporation, Sterling, Virginia, USA) equipped with 1000 N (250 lbf) load cell and connected to a computer programmed with Texture Pro TM texture analysis software (program, DEV TPA With holding time between cycle two second). A flat rod probes uniaxially to compressed the samples with the following parameters conduction to equivalent to a quarter of their original height. Each sample was subjected to two subsequent cycles of compression.

The texture profile parameters (hardness, cohesiveness, springiness, gumminess and chewiness) were calculated from DEV TPA texture analyzer and computer interface. Calculation described by Szczesniak *et al.*¹⁹ and Bourne²⁰.

Water activity (a_w): The major advantages of the chilled mirror dew point methods are speed and accuracy. If there is a problem, the mirror is easily accessible and can be cleaned

quickly in a few minutes. For some applications, fast readings allow manufacturers to perform at-line monitoring of a product's water activity²¹.

Rehydration of marshmallow (soft candies): Rehydration of marshmallow (soft candies) was determined according to the method stated by Von Loesecke²²:

$$\text{Rehydration ratio} = \frac{\text{Drained weight of the rehydration sample (WR)}}{\text{Origin weight of the dehydration sample (WD)}} \times 100$$

Sensory evaluations of marshmallows product: For the sensory analysis a simple hedonic scale with a small number of points (from 1-10 with 1- I don't like it and 10-I like it very much) was used in order to evaluate the first impression according to Watts *et al.*²³.

Statistical analysis: Data were analyzed by Analysis of Variance using General Liner Model (GLM) procedure according to Sendecor and Cochran²⁴. Means were separated using Duncan's test at a degree of significance ($p \leq 0.05$). Statistical analysis were made using the producer of the SAS software system program²⁵.

RESULTS AND DISCUSSION

Physical parameters and chemical composition:

Marshmallow is a confection of foam-like structure due to the presence of gelatin, it possesses good chewing properties and demand for it is constantly growing on the world market. Although the nutritional value of the main types of marshmallow remains very poor, because of the most of them are synthetic, therefore a positive impact go beyond a good colour, taste and smell. Marshmallows are simply described as air bubbles surrounded by sugar syrup. After both of (sucrose, corn syrup and water, is cooked at appropriate temperature to reach the desired water content, which allows air to be whipped into the matrix by mechanical agitation. During whipping, the density of the product decreases as the syrup and foam mixture expands into a light, fluffy marshmallow^{26,27}. The demand for natural color source of such compounds is increasing day by day because of awareness of positive health benefit out of natural compounds as powerful antioxidants pigment/ flavor. Table 1 shows that, some main physical parameters and chemical composition which were determined for a new type of (soft candies)/or marshmallow products also called in this case (dates marshmallow), what made of dates juice. From Table 1, it could be clearly observed that, moisture content for date marshmallow samples was

Table 1: Main physical parameters and chemical composition of date marshmallows (Means $\pm$ SD)

Samples	Moisture content (%)	Total solids (TS)	Fibers	Reducing sugars	Sucrose (%)	Total sugars
Imported control (1)	12.00 $\pm$ 0.06	98.30 $\pm$ 0.18	0.00 $\pm$ 0.00	7.90 $\pm$ 0.04	3.21 $\pm$ 0.02	11.10 $\pm$ 0.03
Local control (2)	13.00 $\pm$ 0.10	94.10 $\pm$ 0.14	0.00 $\pm$ 0.00	9.16 $\pm$ 0.02	3.20 $\pm$ 0.01	12.36 $\pm$ 0.01
Blank	11.07 $\pm$ 0.25	94.50 $\pm$ 0.17	0.00 $\pm$ 0.00	7.53 $\pm$ 0.01	4.41 $\pm$ 0.02	11.94 $\pm$ 0.04
Dates (100%)	18.41 $\pm$ 0.12	81.59 $\pm$ 0.08	0.00 $\pm$ 0.00	9.72 $\pm$ 0.26	2.17 $\pm$ 0.10	11.89 $\pm$ 0.02
Dates (50%)/golden berry (50%)	17.50 $\pm$ 0.17	82.50 $\pm$ 0.15	0.00 $\pm$ 0.00	9.66 $\pm$ 0.12	1.53 $\pm$ 0.04	11.19 $\pm$ 0.02
Dates (50%)/ <i>Tamarindus indica</i> (50%)	19.11 $\pm$ 0.08	80.89 $\pm$ 0.21	0.00 $\pm$ 0.00	9.81 $\pm$ 0.24	0.58 $\pm$ 0.00	10.39 $\pm$ 0.01

All the values are means of triplicate $\pm$ SD

Table 2: Total phenolic, flavonoids and carotenoids of date marshmallow products (Means $\pm$ SD)

Samples	Phenolic (mg g ⁻¹ gallic)	Flavonoids (mg g ⁻¹ queratene)	Carotenoids (mg g ⁻¹ as β -carotene)
Imported control (1)	0.122 $\pm$ 0.02	0.086 $\pm$ 0.01	0.5760 $\pm$ 0.03
Local control (2)	0.048 $\pm$ 0.00	0.094 $\pm$ 0.01	0.7760 $\pm$ 0.02
Blank	0.098 $\pm$ 0.01	0.137 $\pm$ 0.02	0.0017 $\pm$ 0.00
Dates (100%)	0.098 $\pm$ 0.01	0.217 $\pm$ 0.03	0.7800 $\pm$ 0.01
Dates (50%)/golden berry (50%)	0.072 $\pm$ 0.02	0.191 $\pm$ 0.01	0.9290 $\pm$ 0.02
Dates (50%)/ <i>Tamarindus indica</i> (50%)	0.264 $\pm$ 0.04	0.177 $\pm$ 0.02	0.8500 $\pm$ 0.01

All the values are means of triplicate $\pm$ SD

Table 3: Objective testing color measurements for date marshmallows products (Means $\pm$ SD)

Samples	Color intensity		
	*L	**a	***b
Imported control (1)	73.03 $\pm$ 0.15	0.12 $\pm$ 0.01	5.33 $\pm$ 0.02
Local control (2)	69.05 $\pm$ 0.06	0.09 $\pm$ 0.01	4.56 $\pm$ 0.05
Blank	77.00 $\pm$ 0.08	1.96 $\pm$ 0.02	12.59 $\pm$ 0.16
Dates (100%)	62.00 $\pm$ 0.12	0.03 $\pm$ 0.00	2.85 $\pm$ 0.04
Dates (50%)/golden berry (50%)	65.04 $\pm$ 0.14	0.07 $\pm$ 0.01	3.01 $\pm$ 0.01
Dates (50%)/ <i>Tamarindus indica</i> (50%)	66.60 $\pm$ 0.09	0.08 $\pm$ 0.02	3.95 $\pm$ 0.02

*L: Lightness (0 = black, 100 = white), **a: Redness and greenness (0 = green, 60 = red), ***b: Yellowness and blueness (0 = bluer, 60 yellow), all the values are means of triplicate $\pm$ SD

more than both of controls but blank was the less one, according to Ergun *et al.*²⁷. Total solids were lower in all samples than control and blank. Dates (100%) sample in its sucrose contain was <2 controls and blank but was more than two other samples which had mixed with (50%) both of golden berry and *Tamarindus indica*. This indicates that, mixing the juice of dates with fruit juice such as golden berry and *Tamarindus indica* with ratio 50% due to reduce it's the content of sucrose. Total sugars contain of samples were less than control (2), but reducing sugars recorded less value in both of blank and control (1) than other one. Total sugars containing all new types of natural source marshmallows were less including blank and control (1). These are also, mean that, the mixing with (50%) both of golden berry and *Tamarindus indica* benefit in reducing the percentage of total sugars for samples dates, but almost close to the proportion of imported control(1).

Main important compound contents: Table 2 showed that, the phenolic in both of the samples local control (2) blank and dates, 100% as well as dates, 50%; golden berry, 50% were little, as for dates, 50%; *Tamarindus indica*, 50% was the higher than imported control (1). Flavonoids were the highest value

in samples dates, 100% followed by dates, 50%; golden berry, 50% dates, 50%; *Tamarindus indica*, 50% compared with blank followed by both controls imported (1) and local (2) their less content of flavonoids. It noticed that, carotenoids recorded the highest content in all samples including local control (2) except blank was less one⁴.

Sensory characteristics: The hunter L, a, b color scale may be used on any object whose color may be measured. From Table 3 data shows that, it could be clearly observed, the lightness values (*L) for sample [dates 100%] equal (62.00) was less than both treatments of dates, 50%; golden berry, 50% and dates, 50%; *Tamarindus indica*, 50% which had (65.04 $\pm$ 0.14, 66.60 $\pm$ 0.09) with compared to blank, imported control (1) and local control(2)] were lightness had (*L) values of (77.00 $\pm$ 0.08 to 69.05 $\pm$ 0.06), that mean the 3 samples not displayed lighter, compared to blank; imported control (1) and local control (2). All samples appeared to have low (*L) value (indicating dark color) which not pure sugar, as shown in the table. On other hand, the red value (**a) of dates, 100% equal (0.03 $\pm$ 0.00) was also less than dates, 50%; golden berry, 50% and dates, 50%; *Tamarindus indica*, 50% which had (0.07 $\pm$ 0.01, 0.08 $\pm$ 0.02) in compared to blank, local control

Table 4: Textural attributes such as texture profile parameters/water activity for date marshmallow products

Samples	Parameters						
	Physical properties						
	Hardness (g)	Cohesiveness (~)	Springiness (mm)	Gumminess	Chewiness (g mm ⁻¹)	Water activity	Moisture content (%)
Imported control (1)	3.10 ^a	0.89 ^a	5.00 ^b	2.80 ^a	13.85 ^a	0.635 ^b	12.00 ^{bc}
Local control (2)	1.60 ^b	0.87 ^a	6.24 ^{ab}	1.40 ^b	8.85 ^c	0.724 ^{ab}	13.00 ^b
Blank							
a (15%)	1.50 ^b	0.87 ^a	9.00 ^a	1.30 ^b	11.61 ^b	0.789 ^{ab}	11.07 ^c
b (12%)	2.10 ^{ab}	0.86 ^a	6.75 ^{ab}	1.80 ^{ab}	12.12 ^{ab}	0.806 ^a	10.06 ^{ab}
Dates (100%)	2.10 ^{ab}	0.87 ^a	6.25 ^{ab}	1.80 ^{ab}	11.33 ^b	0.715 ^{ab}	18.41 ^a
Dates (50%)/golden berry (50%)	1.60 ^b	0.87 ^a	6.24 ^{ab}	1.40 ^b	8.25 ^c	0.729 ^{ab}	17.50 ^{ab}
Dates (50%)/ <i>Tamarindus indica</i> (50%)	2.10 ^{ab}	0.87 ^a	6.25 ^{ab}	1.80 ^{ab}	11.30 ^b	0.745 ^{ab}	19.11 ^a

Means followed by different letters in the same column are significantly different at $p \leq 0.05$

(2) and imported control (1) in value averaged from $(1.96 \pm 0.02$ to $0.12 \pm 0.01)$ as a result were observed. In fact red value (**a) decreased when samples of natural source or not pure sugar. Also, yellowness (**b) values $(2.85 \pm 0.04, 3.01 \pm 0.01, 3.95 \pm 0.02, 4.56 \pm 0.05, 5.33 \pm 0.02)$ for treatments dates, 100% followed by dates, 50%; golden berry, 50%, dates, 50%; *Tamarindus indica*, 50% and local control (2) as well as imported control(1) were less than blank, hence can be best represented by hunter color (**b) to distinguish the color difference of the resulting marshmallow dates. From those results, it is concluded that, there is a convergence in the color for the date marshmallow products with 2 controls samples, indicating that the process of mixing dates (golden berry and *Tamarindus indica*) did not change the color significantly, so that the products produce in their original colors which refer to the original or basic product²⁸.

Ergun *et al.*²⁷ mentioned that, water is one of the most important components of confections. Progressing from the use of water content to water activity, to the principles of water mobility. One of the main functions of water in confectionery formulas is to dissolve the ingredients and help with mixing. In most candies, the water is used to dissolve and prepare the slurry of sugar and corn (glucose) syrup. Marshmallows may be either ungrained or grained, depending on the ratio of sucrose to corn syrup. Water content affects marshmallow hardness and flow properties. Ungrained marshmallows typically have moisture content of 15-18%. A fresh-made, ungrained marshmallow has fairly high a_w , above 0.7, dependent on moisture content and composition. From Table 4 data showed that, physical properties-texture attributes are (hardness, cohesiveness, springiness, gumminess and chewiness). Physical structure is often altered by changes in water activity due to moisture gain resulting in a transition from the rubber to the glassy state. On the other side also reveal that, there is a reverse relationship between marshmallow products hardness and its water content in

table. The data showed that, had significant difference for water content in all suggestion marshmallow, when fresh and throughout the ripening period.

From data shown in Table 4 the hardness attribute for imported control (1) marshmallow was the best followed by the marshmallow sample of the blank, 12%; dates, 100%; dates, 50%; golden berry, 50% and dates, 50%; *Tamarindus indica*, 50% but the lowest sample of marshmallow blank, 15%. Cohesiveness showed that, there is no significantly different between all samples marshmallow. Springiness showed that there is no significantly different for samples local control (2); blank, 12%; dates, 100%; dates, 50%; golden berry, 50% and dates, 50%; *Tamarindus indica*, 50% marshmallows compared with imported control (1) followed by blank, 15% and imported control (1) are the lowest with significantly differences between them. Gumminess; imported control (1) were the best followed by blank, 12%; dates, 100% and dates, 50%; *Tamarindus indica*, 50% but blank, 15% and local control (2) as well as dates, 50%; golden berry, 50% marshmallow were the worst. Chewiness; imported control (1) followed by blank, 12 and 15% and dates, 100% as well as dates, 50%; *Tamarindus indica*, 50% marshmallow were the best one. On the other hand, local control (2) and dates, 50; golden berry, 50% were the worst by there are moderate significantly differences. Water activity (a_w); both of local control (2) as well as both of samples dates, 100%; dates, 50%; golden berry, 50% and dates, 50%; *Tamarindus indica*, 50% marshmallow had the highest values, this means the least quality. On the other hand, imported control (1) was the best one, followed by blank ratio (15%) was the lower values than ratio (12%) that means the best one. Lim *et al.*²⁹ studied that, the initial water content of the marshmallow was 19.5% and though water activity was not measured, it was probably between 0.65 and 0.70 if not higher. After 20 weeks of storage, the marshmallow water content had decreased to 7.9% and hardness had increased.

Table 5: Rehydration ratio samples for date marshmallow products

Samples	Reconstitution/time (every 1 h)					
	1 h	2 h	3 h	4 h	5 h	6 h
Imported control (1)	127.56 ^a	138.95 ^a	142.60 ^a	146.24 ^a	146.70 ^a	150.80 ^a
Local control (2)	101.55 ^{bc}	83.51 ^{bc}	69.24 ^b	56.77 ^b	42.39 ^b	33.19 ^b
Blank	90.23 ^c	86.67 ^{bc}	77.82 ^b	67.47 ^b	57.13 ^b	47.59 ^b
Dates 100%	72.18 ^d	61.58 ^c	55.79 ^b	41.53 ^b	32.06 ^b	29.94 ^b
Dates (50%)/golden berry (50%)	81.41 ^{cd}	69.72 ^{bc}	58.32 ^b	45.73 ^b	33.73 ^b	23.24 ^b
Dates (50%)/ <i>Tamarindus indica</i> (50%)	89.23 ^{cd}	67.44 ^{bc}	58.63 ^b	46.04 ^b	37.09 ^b	29.83 ^b

Means followed by different letters in the same column are significantly different at $p \leq 0.05$

Table 6: Sensory evaluation of date marshmallow products

Samples	Color	Taste	Flavor	Texture	Acceptability
Imported control (1)	6.9 ^{ab}	6.4 ^b	6.3 ^b	6.5 ^b	6.9 ^b
Local control (2)	6.6 ^b	7.5 ^{ab}	6.8 ^{ab}	6.6 ^b	6.7 ^b
Blank	8.0 ^a	8.5 ^a	7.8 ^a	7.4 ^a	8.8 ^a
Dates 100%	7.5 ^{ab}	8.8 ^a	7.6 ^a	7.9 ^a	8.9 ^a
Dates (50%)/golden berry (50%)	8.0 ^a	7.4 ^{ab}	6.7 ^{ab}	6.8 ^b	7.9 ^a
Dates (50%)/ <i>Tamarindus indica</i> (50%)	6.5 ^b	6.8 ^b	6.6 ^b	7.5 ^a	8.0 ^a

Means followed by different letters in the same column are significantly different at $p \leq 0.05$

Table 7: Main physical parameters and chemical composition for date sheets after being storage at ambient temperature ($25 \pm 2^\circ\text{C}$) for 3 months

Treatments	Parameters					
	Moisture content (%)	Total solids (TS)	Total phenolic compounds (mg)	Fibers (g/100 g)	Total acidity (as citric acid)	Vit. C (mg/100 g)
Control (apricot sheets)	11.33	88.67	55.5	6.35	0.98	0.08
Date sheets product (zero time)	14.87	85.13	54.8	6.25	0.96	0.07
Date sheets product (3 months)	16.82	83.18	54.5	5.98	0.92	0.09

From these results which are shown in Table 5: Imported control (1) increased by increasing time of the soaking and was supposed to decrease with increasing the rehydration time, while the all of other samples as blank; dates, 100%; dates, 50%; golden berry, 50% and dates, 50%; *Tamarindus indica*, 50%, respectively, take to decrease including locally control (2). Finally, it is noticed that, more than (2 h) of the rehydration time had occurred deterioration for reconstitution ratio values of marshmallow samples by increasing time of soaking with no significant differences between them compared with imported control (1) and dates, 50%; golden berry, 50% and dates, 50%; *Tamarindus indica*, 50% as well as locally control (2) was the worst value, according to Kirtil *et al.*³⁰.

The data showed that no significant difference in color in dates, 100% and imported control (1) marshmallow. Taste showed no significant difference between local control (2) and dates, 50%; golden berry, 50%; blank; dates, 100% as well as imported control (1) and dates, 50%; *Tamarindus indica*, 50% while flavor of marshmallow samples were recorded the same score in arrangement. Texture showed no difference between imported control (1) local control (2) and dates, 50%; golden berry, 50% also blank; dates, 100% and dates, 50%; *Tamarindus indica*, 50%. Acceptability, all samples recorded highest score except imported control (1) and local control (2)

showed lower score. It can be concluded that, the moderate scores of the sensory parameters showed in (Table 6) suggestion marshmallow which contain imported control (1) and local control (2) as well as dates, 50%; *Tamarindus indica*, 50%. It could be observed that, samples blank; dates, 100% and dates, 50%; golden berry, 50% marshmallow, respectively, had the same record highest score of taste, flavor and palatability and the better than artificial marshmallows according to Artamonova *et al.*³¹ and Salană *et al.*³².

Effect of storage on sensory qualities: Date fruits have a very high nutritional value. It consist of 70% carbohydrates (mostly sugars), making it one of the most nourishing natural foods available to man. It also contains proteins, fats, crude fibers, vitamins, mineral, enzymes and other useful substances. The water ranged between 15-30% depending on the variety and on the maturity stage of the fruit. Having characteristics of low fats, appropriate moisture contents, carbohydrates and other nutritional values with a sweet and supple taste and texture along with a chewing pleasure, dates are considered as complete food and are cherished all around the world. From Table 7, it could be observed that, moisture content of date sheets (zero-times and 3 months) were between 14.87 and 16.82%, these results were more than the moisture content of control. Most fruit leathers are dried at $30-80^\circ\text{C}$,

Table 8: Effect of storage for date sheets on soluble sugars after being at ambient temperature ($25 \pm 2^\circ\text{C}$) for 3 months

Treatments	Parameters		
	Total sugar	Reducing sugars	Non-reducing sugar
Control (apricot sheets)	69.6	46.1	23.5
Date sheets product (zero time)	72.8	46.6	26.2
Date sheets product (3 months)	71.5	46.1	25.4

Table 9: Objective testing color measurements for date sheets products after being storage at ambient temperature ($25 \pm 2^\circ\text{C}$) for 3 months (Means $\pm$ SD)

Treatments	Color intensity (hunter calorimeter, L, a, b)		
	*L	**a	***b
Control	19.95 $\pm$ 0.02	3.85 $\pm$ 0.02	3.50 $\pm$ 0.01
Date sheets product (zero time)	19.59 $\pm$ 0.01	3.95 $\pm$ 0.00	3.55 $\pm$ 0.01
Date sheets product (3 months)	20.12 $\pm$ 0.04	3.55 $\pm$ 0.01	3.08 $\pm$ 0.02

*L: Lightness (0 = black, 100 = white), **a: Redness and greenness (0 = green, 60 = red), ***b: Yellowness and blueness (0 = bluer, 60 = yellow), all the values are means of triplicate $\pm$ SD

Table 10: Rehydration ratio for date sheets products after being storage at ambient temperature ($25 \pm 2^\circ\text{C}$) for 3 months

Treatments	Reconstitution/time (min)				
	30	60	90	120	150
Control	85.71 ^b	85.71 ^b	71.42 ^b	57.14 ^b	42.86 ^b
Date sheets product (zero time)	85.71 ^b	85.71 ^b	71.42 ^b	57.14 ^b	42.86 ^b
Date sheets product (3 months)	114.29 ^a	114.29 ^a	100.00 ^a	100.00 ^a	85.71 ^a

Means followed by different letters in the same column are significantly different at $p \leq 0.05$

Table 11: Sensory evaluation of date sheets products after being storage at ambient temperature ($25 \pm 2^\circ\text{C}$) for 3 months

Treatments	Color	Taste	Flavor	Texture	Acceptability
Control	7.6 ^a	8.7 ^a	8.1 ^a	8.6 ^a	8.5 ^a
Date sheets product (zero time)	7.7 ^a	8.4 ^b	7.9 ^a	7.9 ^b	8.7 ^a
Date sheets product (3 months)	7.7 ^a	8.0 ^c	7.8 ^a	7.9 ^b	8.8 ^a

Means followed by different letters in the same column are significantly different at $p \leq 0.05$

especially at $50-60^\circ\text{C}$ for up to 24 h or until they have reached the final moisture content of 12-20% (w.b.) Diamante *et al.*¹⁰. Total phenol compounds for samples (54.8 and 54.5 mg), respectively, were less than control (55.5). On the other hand, fibers, total acidity and vitamin C was close and almost compatible with the control (6.35, 6.25 and 5.98 g/100 g) (0.98, 0.96 and 0.92) and (0.08, 0.07 and 0.09), respectively.

These results from Table 8 for effect of storage at ($25 \pm 2^\circ\text{C}$) of shelf-life on soluble sugars of date sheets (zero-times and 3 months) compared with control (apricot sheets) were noticed that, the total sugar, reducing and non-reducing sugars were less the longer storage. Knowing that, we couldn't compare here with apricot sheets because originally is low in the content of soluble sugars as shown from the table.

The hunter L, a, b color scale may be used on any object whose color may be measured. From Table 9, it could be clearly observed that, treatment of [date sheets product (zero time)] for the lightness values (*L) equal (19.59 ± 0.01) was less than date sheets product (3 months) which lightness had (*L) values of (20.12 ± 0.04) compared with control as shown in the table that were appeared to have low (*L) value (indicating dark color). On other hand, the red (**a) value equal (3.95 ± 0.00) for date sheets product (zero time) was more than value (3.55 ± 0.01) for date sheets product (3 months) compared with control (3.85 ± 0.02) as a result were observed. In fact red value (**a) decreased when the time of storage were increased, while the yellowness (***b) values (3.55 ± 0.01) for date sheets product (zero time) was also, more than values (3.08 ± 0.02) of date sheets product (3 months) in compered with control by increasing time of storage, that hence can be best represented by hunter color ***b to distinguish the color difference of the resulting sheets dates. From these results, it conclude that, there is a convergence in the color for the date sheets products with control sample, indicating that the storage at ambient temperature ($25 \pm 2^\circ\text{C}$) for 3 months did not change the color significantly, so that the products produce in their original colors which refer to stability of their color^{29,33}.

From these results which is shown in Table 10. All samples were decreased by increasing time of the soaking. It can be concluded that, there are significantly different of there constitution ratio parameters between samples of sheets (3 moths) and [control and samples (zero-time)] sheets samples which had showed in (10) suggestion sheets of samples, Diamante *et al.*¹⁰ reported that, these ingredients are mixed with the fruit puree to make fruit leathers with a higher quality, longer storage or better organoleptic quality than the original fruit. Most fruit leathers are dried at $30-80^\circ\text{C}$, especially at $50-60^\circ\text{C}$ for up to 24 h or until they have reached the final moisture content of 12-20% (w. b.).

The data showed that, no significant difference in color, flavor and acceptability in all suggestion sample sheets. Texture showed no significant difference between samples (zero time and 3 months) while control sheets recorded the highest score. Taste showed difference between all samples. Control sample sheet recorded the highest score next (zero time and 3 moths, respectively). It can be concluded that, taste had significantly different scores of the sensory parameters showed in (Table 11) suggestion sheets of samples. This study is a new application of dates to produce a new product which will be used as a commercial food product to be introduced in local markets.

CONCLUSION

It could be finally concluded through this study, it is proper, successful economic and applicable to produce vegetables and fruits marshmallows giving the same amount of taste and aroma, hence we must resort to natural sources which are very suitable to be taken as a good natural food or natural-food additive with many categories of healthy foodstuffs. The phytochemical analysis of the marshmallows and sheets dates revealed it being a good source of total phenolic and flavonoids. These compounds which found naturally in dates protect body from free radical, improve immune system and also have health benefits. Date marshmallow and sheets as new products had given added value for second degree dates. Results obtained from the investigation in this study may help in expanding the utilization of this date for commercial gain.

SIGNIFICANCE STATEMENT

This study evaluate the production of high quality natural marshmallow and sheets dates as new products for an added value for second degree types of dates. Value addition is another important segment in the date consumption pattern in the world. These value added products are highly viable commercially. It is also extended to study the possibility of production of restructure by using pectin in processed sheets. This study will help the industry to economic and applicable to produce vegetables and fruits marshmallows giving the same amount of taste and aroma.

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