

Novel Products from Amhat Date

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Abstract: The aim of this study is to introduce new products of fresh Amhat dates, which could be industrials processed and consumed all over the year as the production of dates in Egypt is high while the quantity processed in food industry is very limited. In this investigation, seven main products of Amhat dates were Amhat dates jam (AJ), Amhat dates jam with orange (AJO), Amhat dates spread with tehina (AST), Amhat dates spread with tehina and dark chocolate (ASTC), Amhat dates spread with hazelnut (ASH), Amhat dates sweet without cacao powder (AS) and Amhat dates sweet with cacao powder (ASC). Physiochemical and organoleptic characteristics were determined. In addition, identification and quantification of sugars, phenolic, flavonoid compounds, vitamins B group and A, D, E, K were determined by HPLC. The results showed high percentage of total soluble solids in the jam products (AJ and AJO) and high proportion of fat and protein in all spread products and Amhat dates sweet with cacao powder, also, high minerals and antioxidants activity in all processed products. The results obtained by HPLC for Amhat date of all products identified and quantified sugars, phenolic and flavonoids compounds. Sugars fructose, glucose and xylose represented the highest content of sugars, also, pyrogallol, E-vanillic acid, Alpha-coumaric acid, benzoic acid, elegiac acid and chlorogenic acid are the most important and dominate phenolic compounds, moreover hesperidin, acacetin, rutin, rosmarinic, and naringin had the highest levels of flavonoid compounds. The group of vitamins B12, B9, B6, B3 and vitamin K represented the highest percentage in all products of Amhat dates. The sensory evaluation showed that all products manufactured from Amhat dates were palatable by all panelists, especially product spread Amhat date with tahina and chocolate (ASTS), which it scored the high values given by panelists.

Keywords: Amhat dates, products, chemical composition, nutritional value, antioxidants activity.

INTRODUCTION

Egypt is the largest country production dates in the world, with a production 1.684.917 tons, planting area of 115610 (fed.) representing 17.7% of worlds production. The Egyptian dates are divided into three categories (soft, semi-dry and dry dates). Amhat date is one of the most important soft dates in Egypt, which represents about 38262 tons, from planting area of 2164 (fed.) (AACCS, 2015). Amhat dates variety is very sensitive to spoilage and is subjected to fermentation in few days after ripening (rutab stage). This means that Amhat dates must be consumed during few days after natural or artificial ripening to rutab stage (Nezam El-Din and Abd El-Hameed, 1997a). Amhat dates were preserved at Khalal stage in sugar solution (30%) with different additives (ascorbic acids or lime juice), sterilized in jars and stored for 8 months. The results revealed that treated solution by ascorbic acid showed the best color, taste and flavor during storage and reduce the loss and spoilage of this variety (Nezam El-Din and Abd El-Hamed, 2004).

Date powder was prepared from the khalal stage of Amhat, Siwi and Hayani date varieties and unpollinated Siwi date, the organoleptic evaluation of date powder revealed that color, taste and flavor of khalal date of the previous different varieties mixed with the unpollinated Siwi date were enhanced and acceptable compared to the powder of unpollinated date alone (Nezam El-Din and Abd-El-Hamed, 2003).

Dates fruits rich in carbohydrates (44–88%), mainly glucose and fructose, protein 2.3 - 5.6 % and fats 0.2-0.5%, good source of vitamins B complex, dietary fiber, minerals, phenolic, carotenoids and antioxidants (Nasir *et al.*, 2015). Date fruits have bioactive

components like carbohydrates, dietary fiber, minerals, some essential vitamins and photochemical such as phenols, sterols, carotenoids, anthocyanins, procyanidins and flavonoids compounds (Baligo *et al.*, 2011).

Radwan *et al.* (2015) produced high quality products from soft dates (Hayani and Amhat) at rutab stage. They dehydrated the date after deseed and mincing then mixed with some concentrated juices (mango, apricot, guava and strawberry). Sensory evaluation showed that mixing the dates with 20% fruit juices concentrate were better than 10%, also using the dehydrated dates with ground biscuit and Kamar El-din sheet gave high palatability scores. The present study aimed to produce high quality new products by using new forms for consuming the Amhat dates at rutab stage.

MATERIALS AND METHODS

Materials

Amhat dates variety at rutab stage and Orange fruits were obtained from Filed Crops Research Institute, Agricultural Research Center, Giza, Egypt.

Milk powder, sugars, white honey, butter, hazelnut, dark chocolate, cacao powder, dream whip, wheat flour, raisin, coconut, sesame and tahina were purchased from the local market in Giza governorate, Egypt.

All chemicals and reagents used in this study were of analytical grade and purchased from El-Gomhouria Co., chemicals used in HPLC methods were of HPLC grade and purchased from (Sigma – Aldrich Co. UK).

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METHODS

Preparation of Amhat dates product

Preparation of Amhat dates jam

Fresh Amhat was washed and cleaned by water, decapod and deseeded and then divided into two parts as follows:

The first: 1000 g of Amhat dates was mixed with 500 g sugar, citric acid was added, then the mixture were cooked until final product contained 67.2% total soluble solids for product Amhat dates jam (**AJ**).

The second: 800 g of Amhat date mixed with 500 g sugar, 125 ml orange juice and 75 g orange peel, citric acid was added, then the mixture were cooked until final product contained 64.18% total soluble solids for product Amhat dates jam with orange (**AJO**). Final jam (**AJ** and **AJO**) were kept in sterilized glass jars.

Preparation of Amhat dates spread

Amhat dates were prepared as the above-mentioned treatments, and divided into three parts as follows:

The first: 500 g of Amhat dates were blended, heated for 5 minutes, then mixed with 50 g milk powder, 100 g white honey and 250 g tahina for produce product Amhat dates spread with tehina (**AST**).

The second: the previous ingredients were mixed with 200 g dark chocolate for produce product Amhat dates spread with tahina and dark chocolate (**ASTC**).

The third: 800 g Amhat dates mixed with 40 g sugar, 50 g butter, 125 g hazelnut 100 g dark chocolate, 100g cacao powder, 40 g cream wipe and 50 ml boiled water in blender for produce products Amhat dates spread with hazelnut (**ASH**).

The obtained final spread (**AST**, **ASTC** and **ASH**) were packed in sterilized glass jars.

Preparation of Amhat dates sweet

Amhat dates were prepared as the above-mentioned treatments, and divided into two parts as follows:

The first: 500 g of Amhat dates were blended, heated for 10 minutes, 200 g of butter mixed with 300 g wheat flours, heated till roasted, in this step add heated Amhat dates mixed and stir till the mixture is smooth for produce products Amhat dates sweet (**AS**).

The second: the previous ingredients were mixed with 100 g cacao powder and 50 ml boiled water for produce products Amhat dates sweet with cacao powder (**ASC**). Finally, Amhat dates sweet (**AS** and **ASC**) were formed in suitable shape.

Chemical analysis

Moisture content, crude protein, fat, total soluble solids (TSS), ash, pH value and total acidity were determined according to the methods of AOAC (2010). Antioxidant activity was determined by the method of Sheng and Silva (2006).

Determination of minerals

Minerals (Ca, Mg, Fe, Zn) were measured using Perkin Elmer Atomic Absorption Spectrophotometer (Model 2380, Japan), on the other hand Mn and K were

determined using Flame Photometer (model PE P7, England) as described with AOAC (2010).

Identification and quantification of sugars by HPLC

The sugars of fresh Amhat dates and their products were fractionated and identified by HPLC (Hewlett Packard, series 1050 county origin) according to the method of (Chinnici *et al.*, 2005).

Identification and quantification of phenolic and flavonoid compounds by HPLC

Fractionation and identification of phenolic compounds were carried out by HPLC according to the method described by Pascale *et al.* (1999), while flavonoid compounds were carried out by HPLC according to the method described by Pirjo *et al.* (2000).

Determination of vitamins

Vitamins B group were determined by HPLC according to the method of Papadoyannis *et al.* (1997). Vitamin E and A were determined by HPLC as described by Pyka and Sliwiok (2001). Vitamin K was determined according to Tomas *et al.* (2007), and vitamin D according to Gfimiz-Gracia *et al.* (2015).

Sensory evaluation

All the processed products were organoleptically tested for their color, taste, odor, texture and overall acceptability using a scale from 1 to 10 and the decisions were as follows: excellent (10); Very good (8-9); Palatable (6-7) and non-palatable (0-5) according to Larmond (1970).

Statistical analysis

The collected data were recorded as means and analyzed by (SAS) windows (ver.10.1) using one-way (ANOVA) and Duncan comparisons were tested to signify differences between different samples. Value < 0.05 was considered statistically significant. Data were expressed as means, according to (Snedecor and Cochran, 1990).

RESULTS AND DISCUSSIONS

Physicochemical properties of fresh Amhat dates and its products

Data presented in Table (1) showed the physicochemical composition of fresh Amhat dates and its products, it could be noticed that moisture content was 49.73% for fresh Amhat dates, while it ranged from 15.57 to 35.31% for other products. Concerning the protein contents results in Table (1) showed that product AST and ASTC contained high value which being amounted 10.02 and 10.99%, respectively, while products ASH, AS and ASC were recorded 8.25, 5.69 and 5.50%, respectively. For fat content, products AST, ASTC, ASH, AS and ASC had the highest content which ranged from 17.31 to 21.83%.

From Table (1), it could be observed that total soluble solids recorded 67.2 and 64.18% for AJ and AJO, respectively, while a clear variation was observed between the other products. This variation related to the different ingredients that used in these products. Product ASH had the highest content of ash (2.71%) followed

by product AST and ASTC, while the other products had ash ranging from 0.83 to 1.84%, respectively. pH value was 6.76 for fresh Amhat dates, while it also ranged from 4.72 to 6.90 for its products, total acidity is nearly constant at 0.2% in all products except very slight increments, which occurred in few treatments. Regarding the antioxidant activity results in Table (1) showed that antioxidant activity of fresh Amhat dates

was 63.3%, while ASC recorded the highest antioxidant activity (91.8%) and for the other products, it ranged from 61.3 to 88.7%. Wang *et al.* (2010), reported that the interaction occurred during heat processed, synergies between antioxidant compounds and the food matrix can occur, in other studies, antioxidant activity remained constant (Leitao *et al.*, 2011) or can be decreased (Davidov *et al.*, 2011).

Table (1): Physicochemical properties of fresh Amhat dates and its different products (on dry weight basis)

Constituents %	Fresh Amhat dates	Jam		Amhat dates spread			Amhat sweet	
		AJ	AJO	AST	ASTC	ASH	AS	ASC
Moisture	49.73	15.57	21.04	32.74	26.82	35.31	28.37	20.14
Protein	1.5	1.3	1.4	10.02	10.99	8.25	5.69	5.50
Fat	1.3	1.1	1.02	21.83	17.31	21.59	20.59	19.04
Total soluble solids (TSS)	42.39	67.2	64.18	46.39	29.52	33.39	26.80	19.53
Ash	1.84	0.83	0.83	2.36	2.07	2.71	1.52	1.75
pH value	6.76	5.06	4.72	6.62	6.72	6.90	6.45	6.36
Total acidity (as citric acid)	0.190	0.266	0.352	0.198	0.192	0.189	0.200	0.218
Antioxidant activity	63.3	88.7	79.9	70.6	75.8	61.3	76.2	91.8

AJ: Amhat dates jam

AST: Amhat dates spread with tehina

ASH: Amhat dates spread with hazelnut

ASC: Amhat dates sweet with cacao powder

AJO: Amhat dates jam with orange

ASTC: Amhat date spread with tehina and dark chocolate

AS: Amhat dates sweet without cacao powder

Nutritional quality of Amhat dates and its products

Mineral contents

Table (2) showed the composition of elements, potassium (K), magnesium (Mg), calcium (Ca), manganese (Mn), iron (Fe) and zinc (Zn) on dry weight

basis. Data in Table (2) showed that product ASC had the highest amounts of K (692.47 mg/100g) followed by product AS (387.35 mg/100g), fresh Amhat (370.12 mg/100g) while the lowest was record in product AJO (108.80 mg/100g).

Table (2): Mineral contents of fresh Amhat dates and its products (on dry weight basis)

Minerals (mg/100g)	Fresh Amhat dates	Jam		Amhat dates spread			Amhat sweet	
		AJ	AJO	AST	ASTC	ASH	AS	ASC
Potassium (K)	370.12	176.40	108.80	174.07	312.28	335.35	387.35	692.47
Magnesium (Mg)	91.756	158.022	104.273	228.58	227.79	181.82	92.212	120.49
Calcium (Ca)	157.56	223.08	143.32	226.63	255.07	181.82	40.262	59.450
Manganese (Mn)	0.70	0.708	0.773	0.252	0.299	0.499	0.156	0.364
Iron (Fe)	0.721	0.319	0.201	1.007	0.749	2.496	1.286	2.682
Zinc (Zn)	0.309	0.342	0.371	0.951	1.048	0.535	0.519	0.754

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ASC: Amhat dates sweet with cacao powder

AJO: Amhat dates jam with orange

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Data in Table (2) showed that product ASTC appear to be rich in calcium (255.07), zinc (1.048) and contain considerable amount of magnesium (227.79 mg/100g). As for iron content, products ASC, ASH and AS had the highest content. On the other hand, (Mn) ranged from 0.156 to 0.773 mg/100g for different products. The previous results appeared clear differences between all products in the amounts of minerals, this may be related to ingredients additive. Shaba *et al.* (2015) found that dates fruits contain from Ca, Mg, K, Zn and Fe were 79.62, 66.33, 55.11, 0.86 and 4.56 mg/100g, respectively. On the other hand, the element analysis of date palm extract showed that, the fruit of date palm contains many of valuable and useful elements like calcium, potassium, magnesium and iron in percentages 65, 521, 20 and 2.69%, respectively, El-Sohaimy and Hafez (2010). Youssef *et al.* (1999) determined both macro and micro-elements in some new valley dates and certain dates products, they found that potassium content recorded the highest levels in all varieties, the rutab stage of Saldy dates had gave lesser K, Na, and Fe contents than Balady and Manthour dates, but it was intermediate between them in Ca, Mg and Mn, also the treated and packed saldy dates products differed in minerals content, the date paste followed by pressed dates (Agwa) recorded the highest iron content.

Identification and quantification of sugars contents of fresh Amhat dates and its products

In fresh Amhat dates a large portion of soluble solid is sugars, from Table (3) it could be seen that fresh Amhat dates had the highest amount of fructose, glucose, mannose and galactose (41.45, 32.32, 17.68 and 17.03%, respectively), while sucrose recorded low amounts (0.189%). HPLC analysis of sugars content showed that, the carbohydrate content consists of a large amount of glucose, fructose and sucrose (El-Sohaimy and Hafez, 2010).

Muhammad *et al.* (2014) reported that sucrose converts to reducing sugars especially glucose and fructose with no or very low sucrose. Product AJ and AJO recorded the same value of sucrose (22.18%). As for arabinose product AJO had the highest content than other ones, while maltose content was high in product AJ and AJO as well as xylose had the highest content in product AJ (21.62%) when compared to other products. Other sugars were identified as shown in Table (3) that recorded different low concentration in fresh Amhat dates and its products. The variation between identified sugars of fresh Amhat dates and its processed products may be related to that different ingredients, were used in processing these products.

Table (3): Identification and quantification of sugars contents of fresh Amhat dates and its products (on dry weight basis)

Sugars compounds (g/100g)	Fresh Amhat dates	Jam		Amhat dates spread			Amhat sweet	
		AJ	AJO	AST	ASTC	ASH	AS	ASC
Glucuronic	0.370	0.323	0.190	2.676	0.157	0.122	0.166	0.990
Stackhouse	0.648	0.206	0.305	0.497	0.303	0.195	0.195	0.144
Galacturonic	0.442	0.769	1.077	1.867	1.058	0.424	0.240	0.144
Sucrose	0.189	22.18	22.18	2.449	4.813	1.639	0.747	2.208
Maltose	0.149	23.61	23.62	2.608	5.124	1.744	0.796	2.350
Glucose	32.32	18.53	21.69	11.34	10.26	9.753	11.90	6.836
Xylose	21.62	14.33	17.12	8.929	7.539	7.889	8.912	5.746
Galactose	17.03	0.352	13.49	0.134	0.094	6.214	10.36	0.056
Mannose	17.68	0.366	14.01	0.139	0.098	0.063	0.103	0.059
Arabinose	4.874	29.09	34.49	2.046	18.20	17.36	19.28	11.51
Fructose	41.45	24.74	29.33	17.40	15.48	14.76	16.39	9.807
Mannitol	0.662	0.045	0.013	2.046	1.069	0.079	0.099	0.086
Sorbitol	1.623	0.595	0.505	0.375	0.295	0.275	0.346	0.341

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ASH: Amhat dates spread with hazelnut

ASC: Amhat dates sweet with cacao powder

AJO: Amhat dates jam with orange

ASTC: Amhat date spread with tehina and dark chocolate

AS: Amhat dates sweet without cacao powder

Identification and quantification of phenolic compounds by HPLC

The results in Table (4) showed that the identification and quantification of 23 phenolic compounds in fresh Amhat dates and all processed products as (mg/100 g dw). The highest content of pyrogallol was 83.53 mg/100gm for fresh Amhat dates, followed by product AJ (75.07 mg/100gm), product AJO (14.45 mg/100gm) product ASH (12.22 mg/100gm) and product AS (11.62 mg/100gm), respectively.

Product ASC had high concentration of catechol (18.001 mg/100g), while product AJ had moderate content of catechol (5.157 mg/100g) and the lowest concentration found in product AS (1.216 mg/100g). The highest content of elegiac acid was 14.86 mg/100gm for product AST while e-vinylic recorded the highest content in product ASH (158.mg/100gm) followed by fresh Amhat dates (50.68 mg/100gm), product AS (27.99 mg/100gm), product AJ (26.89 mg/100 gm), product ASTC (21.02 mg/100 gm) and AST (18.74 mg/100gm), respectively.

Table (4): Identification and quantification of phenolic compounds by HPLC of fresh Amhat dates and its products (on dry weight basis)

Phenolic compounds (mg/100gm)	Fresh Amhat dates	Jam		Amhat dates spread			Amhat sweet	
		AJ	AJO	AST	ASTC	ASH	AS	ASC
Gallic acid	5.872	7.822	1.906	0.553	0.229	0.257	0.796	0.686
Pyrogallol	83.53	75.07	14.45	4.844	7.334	12.22	11.62	9.32
4-Amino-benzoic acid	0.296	0.506	0.319	0.120	0.134	0.130	0.092	0.192
Protocatechuic acid	3.044	0.625	1.053	1.935	1.276	1.345	1.009	1.121
Catechin	2.629	1.300	0.885	1.164	1.382	1.820	1.276	0.394
Chlorogenic acid	4.076	3.013	1.092	-	1.279	1.047	0.931	1.022
Chatechol	3.211	5.157	2.869	2.993	3.375	4.178	1.216	18.001
Epi-catechin	1.318	0.791	0.666	0.844	0.655	-	0.494	1.038
Caffeine	0.315	0.313	0.194	1.701	5.254	0.939	0.593	0.781
p-OH-benzoic acid	1.394	0.332	1.843	1.803	-	0.997	0.306	0.636
Caffeic acid	0.710	0.327	0.338	0.128	0.123	0.319	0.110	0.202
Vanillic acid	3.616	1.666	1.724	0.649	1.623	1.643	0.564	1.019
p-Coumaric acid	1.189	0.612	0.585	0.583	0.674	-	0.268	0.272
Ferulic acid	5.719	0.354	0.507	0.384	1.848	-	0.573	0.235
Iso-Ferulic acid	0.448	0.019	0.057	0.165	0.120	1.404	0.247	0.050
Ellagic acid	6.075	3.077	4.349	14.86	3.368	8.490	6.721	8.242
e-Vinillic acid	50.68	26.89	6.506	18.74	21.02	158.7	27.99	5.665
Alpha-Coumaric acid	3.427	88.61	10.60	22.68	12.19	2.359	3.280	1.528
Benzoic acid	5.319	8.105	11.71	39.44	8.938	35.11	17.84	21.89
3,4,5-methoxy-cinnamic acid	1.338	0.854	0.866	-	-	0.804	0.475	0.172
Coumarin	0.907	0.361	0.862	0.422	0.267	0.113	0.126	0.094
Salicylic acid	2.403	0.385	0.604	1.285	0.962	0.745	0.249	0.187
Cinnamic acid	0.207	0.025	0.027	0.039	0.061	0.201	0.029	0.018

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ASTC: Amhat date spread with tehina and dark chocolate

AS: Amhat dates sweet without cacao powder

From the same Table (4) it was noticed that the highest content of alpha-coumaric was 88.61 mg/100gm for product AJ followed by products AST (22.68 mg/100gm), and product ASTC (12.19 mg/100gm), also product AST and ASH had the highest amount of benzoic acid than other ones. On the other hand, the other phenolic compounds of fresh Amhat dates and all processed products recorded a moderate and little concentration between them as shown in Table (4). The variation between all phenolic compounds of processed products may be related to the different ingredients, which used in processing these products.

Our results are in agreement with Al-Farsi *et al.* (2005) who found that date fruits are an excellent source of phenolic and therefore possess an extremely high antioxidant capacity. Date fruits have been reported to contain various phenolics, such as protocatechuic, *p*-hydroxybenzoic, vanillic, syringic, caffeic, coumaric, ferulic, hydroxyl benzoic, hydroxyl cinnamic acids, which contribute significantly to total antioxidant. Ghnimi *et al.* (2017), also found that Phenolic classes of and identified compounds in date fruits were benzoic acids and derivatives (gallic acid, protocatechuic acid, *p*-hydroxybenzoic acid, vanillic acid, syringic acid, and syringic acid) and Cinnamic acid and derivatives (caffeic acid, hydrocaffeic acid, ferulic

acid, *p*-coumaric acid, syringic acid, dactyliferic acid, 2-caffeoylshikimic acid hexosides, 3-caffeoylshikimic acid, 4-caffeoylshikimic acid, 5-caffeoylshikimic acid, caffeoylsinapoyl hexoside, and dicafeoylsinapoyl hexoside), while (Hamad *et al.*, 2015) found that the major phenolic acids in Saudi date fruit varieties were gallic acid, *p*-coumaric acid, and ferulic acid.

Identification and quantification of flavonoid compounds

The results in Table (5) revealed that the hesperidin was the dominant flavonoid component in fresh Amhat dates and its products which recorded high value in product AJO (45.92 mg/100gm) followed by fresh Amhat dates (22.09 mg/100gm), product AJ (16.98 mg/100gm) and other products ranged from 3.466 to 14.28 mg/100gm. Rosmarinic was the major flavonoid in product AST (18.79 mg/100gm) followed by product AJO (16.09 mg/100gm), product ASC (12.63 mg/100gm) and product ASH (10.66 mg/100gm). The investigation revealed that the highest level of flavonoid hesperidin, acacetin and quercitrin were 45.92, 14.62 and 1.939 mg/100 gm, respectively. On the other hand, product ASTC had maximum content from naringin (9.453 mg/100 gm).

Table (5): Identification and quantification of flavonoid compounds by HPLC of fresh Amhat dates and its products (on dry weight basis)

Flavonoid compounds (mg/100g)	Fresh Amhat dates	Jam		Amhat dates spread			Amhat sweet	
		AJ	AJO	AST	ASTC	ASH	AS	ASC
Naringin	1.247	1.143	1.563	4.364	9.453	3.273	1.323	-
Rutin	4.382	3.367	2.258	2.229	2.544	2.832	1.289	1.852
Hesperidin	22.09	16.98	45.92	11.24	12.83	14.28	6.499	3.466
Rosmarinic	-	3.816	16.09	18.79	-	10.66	5.104	12.63
Quercitrin	1.991	1.053	1.939	1.841	0.573	1.749	0.891	1.883
Quercetin	0.509	-	0.403	-	0.167	0.249	-	0.076
Hispertin	0.865	0.891	1.198	-	0.225	0.570	-	0.202
Kaempferol	0.107	0.109	0.086	-	0.167	0.165	0.022	0.149
Rhamnetin	0.103	0.065	0.141	0.054	0.023	0.136	0.017	0.034
Apigenin	0.913	3.219	2.633	0.572	0.509	0.860	0.910	0.473
Acacetin	10.82	4.425	14.62	3.091	0.970	4.789	0.730	3.381

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The other identified flavonoids showed a little change in the content values, the variation between all flavonoid compounds of processed products might be related to the variation in the ingredients used in processing these products. Our result are in agreement

with Ghnimi *et al.* (2017), who found that identified of Flavonoid glycosides and esters compounds in date fruits were Luteolin, quercetin and apigenin, quercetin rhamnosyl-hexoside sulfate, quercetin 3-O-rutinoside (rutin), quercetin hexoside sulfate, quercetin acetyl-

hexoside, isorhamnetin-3-O-rutinoside, isorhamnetin hexoside, chrysoeriol rhamnosyl-hexoside, isorhamnetin acetyl-hexoside, quercetin 3-O-glucoside (isoquercitrin), chrysoeriol hexoside sulfate, and chrysoeriol hexoside.

Lin and Weng (2006), Khan *et al.* (2010), reported that the flavonoids have cardio protective, antioxidant, anti-inflammatory, anti-cancer and antimicrobial properties, and are one of the most potent nutraceuticals in food and phytopharmaceutical products. Therefore, it is paramount to understand the principles of biological activity, bioavailability and metabolism of Amhat dates flavonoids in relation to human health.

Vitamins B group contents and vitamins A, D, E, K of fresh Amhat dates and its products

Some vitamins B (B1, B2, B3, B6, B9 and B12), also vitamins A, D, E, and K levels of fresh Amhat dates and its products are presented in Table (6). Fresh Amhat dates had the highest level of vitamins B2, B3, B6, B9 and B12. Also it showed that the processing of Amhat dates caused a decrease in those vitamins, the results also revealed that fresh Amhat dates contain low amounts of vitamin B1.

Table (6): Vitamins B group contents and vitamins A, D, E, K, of fresh Amhat dates and its products (on dry weight basis)

Vitamins (mg /100g)	Fresh Amhat dates	Jam		Amhat dates spread			Amhat sweet	
		AJ	AJO	AST	ASTC	ASH	AS	ASC
Thiamine (B1)	0.893	0.798	0.747	0.640	0.653	0.691	0.799	0.785
Riboflavin (B2)	4.663	1.983	0.893	2.055	1.454	2.874	1.664	0.970
Nicotinic (B3)	11.280	2.668	2.587	0.309	3.149	3.848	1.692	2.365
Vit. B group								
Pyridoxine (B6)	4.360	3.251	3.894	4.085	4.169	4.009	4.205	3.995
Folic acid (B9)	11.270	3.769	1.145	3.085	3.013	4.603	6.345	6.888
Cobalamin (B12)	32.520	5.839	10.510	13.590	11.390	12.070	7.905	15.040
Vit. A	0.312	0.384	0.404	0.191	0.035	0.047	0.002	0.233
Vit. D	0.285	0.196	0.201	0.149	0.059	0.082	0.029	0.023
Vit. E	0.024	0.055	0.012	0.033	0.005	0.019	0.009	0.254
Vit. K	98.880	7.318	6.686	14.340	18.830	13.640	24.620	28.240

AJ: Amhat dates jam

AST: Amhat dates spread with tehina

ASH: Amhat dates spread with hazelnut

ASC: Amhat dates sweet with cacao powder

AJO: Amhat dates jam with orange

ASTC: Amhat date spread with tehina and dark chocolate

AS: Amhat dates sweet without cacao powder

The reduction in vitamins B groups that would be due to different processing of fresh Amhat date, in the present study is agreement with Fadahunsi (2009), who found a clear different decrease in vitamins B group when study the effect of treatment conditions (soaking, boiling and fermentation with *Rhizopus oligosporus* (SBF) on the water soluble vitamins.

A clear variation was noticed in the amounts of vitamin A, D and E between fresh Amhat dates and its products, on other hand vitamin K recorded a high level (98.88 mg/100g) in fresh Amhat dates that was decreased after treating and processing. El-Sohaimy and Hafez (2010) reported that the palm fruit contains many kinds of vitamins like, A, B1, B2 and Nicotinic acid

with concentrations 0.04, 0.08, 0.05 and 2.20 mg/100g, respectively.

Sensory evaluation of Amhat date products

The organoleptic evaluation is generally the final guide of quality from the consumers point of view (Jimenez *et al.*, 1989). Results showed that all the Amhat dates products were accepted by the panelists, the description of the overall palatability by the panelists ranged between very good and palatable for all Amhat dates products, it could be noticed that product ASTC had the highest score for all sensory parameters compared with the others, while product AS had the lowest mean value, finely a slight variation, was observed in all processed products.

Table (7): Sensory evaluation of Amhat dates products

Products No.	Properties	Color (10)	Taste (10)	Odor (10)	Texture (10)	Overall Palatability (10)
Jam	AJ	7.5 ^{ab}	7.6 ^{ab}	7.7 ^a	7.3 ^{ab}	7.6 ^{ab}
	AJO	7.5 ^{ab}	7.2 ^{ab}	7.8 ^a	7.1 ^{ab}	7.5 ^{ab}
	AST	7.5 ^{ab}	6.9 ^b	7.3 ^a	8.15 ^a	7.5 ^{ab}
Amhat dates spread	ASTC	8.3 ^a	8.4 ^a	7.9 ^a	8.3 ^a	8.4 ^a
	ASH	7.8 ^{ab}	7.6 ^{ab}	7.5 ^a	8.1 ^a	7.6 ^{ab}
Amhat sweet	AS	6.6 ^b	6.5 ^b	6.9 ^a	6.8 ^b	7.2 ^b
	ASC	7.2 ^{ab}	7.1 ^b	7.4 ^a	6.9 ^b	7.4 ^b
L.S.D at 0.05		0.8626	0.9240	0.9613	0.8732	0.6575

Values with different letters in the same column are significantly different at $P < 0.05$

AJ: Amhat dates jam

AJO: Amhat dates jam with orange

AST: Amhat dates spread with tehina

ASTC: Amhat date spread with tehina and dark chocolate

ASH: Amhat dates spread with hazelnut

AS: Amhat dates sweet without cacao powder

ASC: Amhat dates sweet with cacao powder

CONCLUSION

The present study provides data for providing the use of Amhat dates as the source of natural compound, bioactive component and antioxidant content. Seven products were produced for lowering the loss of Amhat dates. According to the results, products of jam, spread, and Amhat dates sweet contained different percentage of nutritional and bioactive compounds factors.

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منتجات جديدة من بلح الأمهات

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تهدف هذه الدراسة إلى تقديم منتجات جديدة من بلح الأمهات التي يمكن تصنيعها وإستهلاكها على مدار العام وذلك لأن الإنتاج في مصر كبير والكمية المصنعة منه محددة جداً، وفي هذا البحث تم إنتاج سبع منتجات هي مربى بلح الأمهات، مربى بلح الأمهات بالبرتقال، بلح الأمهات القابل للفرد بالطحينة، بلح الأمهات القابل للفرد بالطحينة والشيكولاتة، بلح الأمهات القابل للفرد بالبندق، حلوى بلح الأمهات بدون إضافة كاكاو وحلوى بلح الأمهات المضاف لها بودر الكاكاو وتم إجراء الإختبارات الفيزيوكيميائية والتقييم الحسي بالإضافة إلى تحديد السكريات، المركبات الفينولية، الفلافونيدات وكذلك مجموعة فيتامينات B المركبة وفيتامينات A, D, E, K بواسطة جهاز HPLC لبلح الأمهات وجميع المنتجات. أظهرت النتائج وجود نسبة عالية من المواد الصلبة الذائبة في منتجات المربى (مربى بلح الأمهات، مربى بلح الأمهات بالبرتقال) ونسبة عالية من الدهون والبروتين في جميع المنتجات القابلة للفرد وحلوى بلح الأمهات (حلوى بلح الأمهات المضاف لها بودر الكاكاو)، وكذلك ارتفاع نسبة المعادن والنشاط المضاد للأكسدة في جميع المنتجات المصنعة. تم التعرف بواسطة جهاز HPLC على السكريات، فينولات وكذلك مركبات الفلافونويدز حيث كانت سكريات الفركتوز، الجلوكوز، الزيلوز هي السائدة والمركبات الفينولية البيروجالول والفانليك، والالفا - كيوماريك، البنزويك، الالجيك والكلوروجينك تمثل أعلى نسب الفينولات، بينما كانت الفلافونيدات ذات القيم الأعلى هي الهسبيريدين، الأكستين والريوتين والروزمارينك والنانجين سجلت أعلى نسب الفلافونيدات، كما أن مجموعة فيتامينات ب (ب1، ب2، ب9، ب6، ب3) وفيتامين ك كانت عالية في جميع منتجات بلح الأمهات. أظهر التقييم الحسي أن جميع المنتجات المصنعة من بلح الأمهات لاقت قبولاً من جميع المحكمين خاصة لمنتج بلح الأمهات القابل للفرد بالطحينة والشيكولاتة حيث سجلت أعلى قيم من قبل المحكمين.