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Production of New Functional Foods Using Siwe Date (*Phoenix dactylifera* L.)

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ABSTRACT

Siwe date cultivar is one of the most important semi-dry date cultivars in Egypt, which characterized by its nutritional value and its bioactive components. So, this work aims to use of Siwe date fruits and some popular food staffs like chocolate, coconut, cinnamon and coffee in producing some new functional foods, as well as, evaluate the new products chemically, microbiologically and organoleptically. The obtained results demonstrated that, the highest protein and lipids content (4.66 and 12.17 %, respectively) as well as Caloric value (400.461 Kcal/100g) were recorded for the filled date with coconut paste, while date sample filled with cinnamon paste had the highest crude fiber (2.52%). Whereas, coffee filled dates possessed the highest polyphenol and flavonoid contents (556.25 mg GAE/100g and 165.65mg QE/100g, respectively). All new products had iron contents more than RDI, where the daily value ranged between 211.97 % - 313.86%. In addition, both of coconut and coffee filled date samples possessed higher contents of copper (3.084 and 1.734 mg/100g, respectively) and manganese (2.618 and 2.304 mg/100g, respectively) than those of RDI. The predominant phenolic acids for coconut and cinnamon filled dates are Gallic acid (819.68 and 855.46 ppm, respectively) followed by ferulic acid (102.15 and 202.82 ppm, respectively), while, opposite situation was observed for coffee filled date, where ferulic acid was the predominant (1182.06 ppm) followed by Gallic acid (787.76 ppm). Major flavonoids for coconut and cinnamon filled dates are Quercetin (277.84 and 312.08 ppm, respectively), followed by daidzein (114.28 and 103.29 ppm, respectively), then naringenin (49.3 and 81.6 ppm, respectively). Whereas, those of coffee filled date are Quercetin (2253 ppm) followed by Naringenin (1689.29 ppm) then Kaempferol (791.15 ppm). Both of cinnamon and coffee treatments led to improve the microbial quality of the new products comparing with coconut filled sample. In the same time, all new products are highly accepted organoleptically. In conclusion, the results suggested that, the prepared products are good sources of functional ingredients, such crude fiber, some minerals (Fe, Cu and Mn) and bioactive compounds as phenolic acids and flavonoids with potentially desirable effects on human health.

Keywords: Functional foods, date fruits and chocolate, coconut, cinnamon, coffee

1. Introduction

Functional foods are foods that have a potentially positive effect on health beyond basic nutrition. Proponents of functional foods say they promote optimal health and help reduce the risk of disease. Functional Foods can be divided into 3 different groups (Boija, 1995), the first that has specific content of vitamins, minerals fatty acids, or fiber, the second that in which allergy or intolerance substances have been eliminated and the third that contains active constitutes which are not usual nutrients, but positively affects the immune defense and could affect cancer risk, mood or intestinal flora.

Foods could be considered as functional if it is obviously illustrated its useful effect on one or more target function in the body, in addition to its adequate nutritional effects in a way that related to either well-being and health state or disease risk reduction (Diplock, *et al.,* 1999).

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The foods that could be considered as functional foods may be whole, fortified, enriched or enhanced foods that provide health benefits beyond the provision of essential nutrients (e.g., vitamins and minerals), when they are consumed at efficacious levels as part of a varied diet on a regular basis.

One of the oldest cultivated crops in Middle East and North Africa countries, is date palm (*Phoenix dactylifera* L.), it is considered the most important plant in desert and arid areas (Zaid, 1999 and Al-shahib and Marshall, 2003). The role of date palm has been well established the birth of the human race. Date Fruits are popularly consumed in varied regions of the world and a main diet constitute as a staple food in the Arabian region. Date fruits are considered a low-cost food and rich source of certain nutrients as well as a rapid energy source as a result of their higher content of carbohydrates (70–80%) (Al-Hooti *et al.,* 1995; Myhara *et al.,* 1998; Al-Farsi *et al.,* 2005; Al-Farsi *et al.,* 2008 and Safi *et al.,* 2008).

In Egypt, date palms are distributed in all over the country (Nile valley, oases and desert). Cultivated date varieties in Egypt could be categorized as soft dates (Zagloul, Amhat, Hayani, Samani, Bent-Aicha etc) semi–dry dates (Al-Aglani, Siwi, Al-Amri, *et al.,* etc) and dry dates (Ebrimi, Barakawi, Sakouti, etc) **(**Youssef and Ramadan, 1987 and Mohammed, 2000).

Varied compositional researches on date fruit and its by-products stated that dates contain considerable quantity of total phenolics, dietary fiber and vitamins. This demonstrates that dates are rich antioxidants source and could be utilized either functional food or as an ingredient in functional food (Nasir *et al.,* 2015).

Chocolate consumption (as aphrodisiac, confection and folk medicine) has been backed to the period before science proved its useful health desirable effects. Polyphenols content of cocoa and chocolate considered the major effective components on human health which act as antioxidants, antibacterial and antiviral as well as they have potential anti-inflammatory, antiallergenic, cardioprotective, anticarcinogenic, and antihepatotoxic properties (Ackar *et al.,* 2013).

The worldwide consumption of coffee for social meetings, leisure, enhancement of well-being and work performance is strongly recognized. The consumed amounts influence some minerals intake (K, Mg, Mn, Cr), niacin and antioxidant substances. Several studies have illustrated positive impacts of regular coffee-drinking on different health characters of normal people, as metabolic disorders (gallstones, diabetes, liver cirrhosis), psychoactive responses (mood change and alertness), neurological (child hyperactivity, Parkinson's and Alzheimer's diseases), liver function and gonad. Coffee-drinking affects a wide demographic population (from children, adults and older people) with a board health benefits, not as some functional foods which act on a narrow-defined population with a special impact (Jose´ and Teresa Helena, 2005).

Coconut flour may associate in cholesterol and sugar levels controlling in blood and colon cancer preventing. Studies illustrated that high fiber coconut flour consumption could augments fecal bulk (Arancon, 1999).

Cinnamon is one of the most important spices used daily by people all over the world. Cinnamon mainly contains volatile oil and other bioactive components, as cinnamic acid, cinnamaldehyde and cinnamate. Several studies revealed antioxidant, antimicrobial, antidiabetic, anti-inflammatory, anticancer, cardiovascular-disease-lowering and lipid-lowering activities for cinnamon, which has also been demonstrated activities against neurological disorders, such Alzheimer's and Parkinson's diseases (Pasupuleti and Siew, 2014).

This work aimed to produce and evaluate new functional date products using Siwe date fruits and chocolate with Cinnamon or coconut powder or coffee.

2. Materials and Methods

2.1. Plant material and sampling

- Date palm (*P. dactylifera* L.) cultivar Siwe fruits were obtained at the tamr stage from Siwa Research Station orchard in Siwa Oasis, Matrouh, Egypt, during 2017 season.
- Coffee, coconut powder, cinnamon powder, whole powder milk, sugar and crude dark chocolate were purchased from local market.
- Solvents and all chemicals: were obtained from El-Gomhoria Co. Cairo, Egypt.

2.2. Methods

2.2.1. New date products preparation

Date palm fruits were selected for uniformity in color and size, freedom from defects and fungal damage and used within 3 h of arrival at the laboratory. The fruits were flash washed, sprayed with cold hydrogen peroxide (2%) and allowed to dry. The date fruits were divided into four groups (three for filling and the fourth was minced). Each filling group was consisting of 120 fruits. Each group was deseeded and filled with one filling mixtures (see Table 1), then coated with crude dark chocolate. Then the treated fruits were air dried and stored in polyethylene boxes at room temperature (25-30 ^{o}C), till analysis.

Table 1: The formula of new Siwe date products

	Date fruit	Filling mixture	Crude Chocolate	
Date filled by coconut paste	300 g	117 g (100 coconut + 50 whole milk + 115 syrup)	171 g	588
Date filled by cinnamon paste	300 g	129 g (10 minced date:1 cinnamon)	175 g	604
Date filled by coffee paste	300 g	140 g (10 minced date:1 coffee)	166 g	606

2.2.2. Chemical composition

Moisture, Ash, lipids, protein, crude fiber contents were determined according to the method described by AOAC, (2006).

-The carbohydrate content was calculated using the following formula: Available carbohydrate (%), = 100 – [protein (%) + Moisture (%) + Ash (%) + Fiber (%) + Fat (%)] (Mathew *et al.,* 2014).

I. Caloric value:

Caloric value was estimated using the modified Atwater factor as follows: Total energy (Kcal/100g) = [(lipid"g"×9) + (protein"g"×4) + (carbohydrates "g" × 1.1 × 3.75)] as described by Falch *et al.* (2010).

II. Crude fiber

From the pounded sample, 2.00 g were used in triplicates for estimating the crude fiber by acid and alkaline digestion methods using 20% H_2SO_4 and 20% NaOH solutions (AOAC, 2006**).**

III. Total polyphenols

Total polyphenol content (TPC) of date products samples was determined using the Folin-Ciocalteau method at 765 nm (UV-Vis spectrophotometer, Jenway, Staffordshire, UK) (Gao *et al.,* 2000). The total phenol content was expressed as mg gallic acid equivalents/100g (mg GAE/100g).

IV. Total Flavonoids Content

The flavonoids content was determined spectrophotometrically as reported elsewhere (Yoo *et al.,* 2008). Absorbance was read at 510 nm. The levels of total flavonoid content were determined in triplicate and expressed as mg quercetin equivalents/100g (mg QE/100g).

V. Minerals content

Minerals content was determined using the Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) (Varian- VISTA-MPX, Australia) with Coupled Captured Detector (CCD), where sodium and potassium were determined using Gallenkamp Flame analyzer.

VI. Determination of total viable count (TVC)

Total viable count was carried out using the method of Frazier, (1976), 1g of representative sample was added into a sterile test tube containing 9 ml of ringer's solution, the sample was mixed thoroughly by shaking to 10 serial dilutions. Each dilution was aseptically transferred into triplicate sets of disposable sterile petri-dishes which contain nutrient agar. The petri-dishes were mixed and gentle shaken and allowed to form solid. These were incubated at 37^{o}C for 24 hours after which the colonies were counted. Results were expressed as cfu /g. of date products.

VII. Mold and Yeast enumeration:

Mold and yeast counts were determined using the plate counts technique on potato dextrose agar (PDA) according to procedures by A.P.H.A. (1976) and Difco-Manual (1984). The plates were kept 3 days at 28 ºC.

VII. Determination of phenolic compounds by HPLC

HPLC analysis was carried out using an Agilent 1260 series. The separation was carried out using Eclipse C18 column (4.6 mm x 250 mm i.d., 5 µm). The mobile phase consisted of water (A) and 0.05% trifluoroacetic acid in acetonitrile (B) at a flow rate 0.9 ml/min. The mobile phase was programmed consecutively in a linear gradient as follows: 0 min (82% A); 0–5 min (80% A); 5-8 min (60% A); 8-12 min (60% A); 12-15 min (82% A) ; 15-16 min (82% A) and 16-20 (82%A). The multi-wavelength detector was monitored at 280 nm. The injection volume was 5 µl for each of the sample solutions. The column temperature was maintained at 40 °C.

VIII. Sensory evaluation

Sensory quality of the new Siwe date products were evaluated by 15 panelists from the staff of Agriculture Industrialization Unit, Desert Research Center. Panelists were asked to evaluate taste, odor, texture, outer appearance, internal appearance and Overall acceptability, using a 7-point hedonic scale (Lawless and Heymann, 1998). where, 1- dislike extremely, 2 - dislike moderately, 3 – dislike slightly, 4 - neither like nor dislike, 5 - like slightly, 6 - like moderately, and 7 - like extremely.

2.3. Statistical analysis

A completely randomized experimental design was selected to define the treatments effect. All determinations were carried out in triplicate (except minerals and phenolic compounds) and data is reported as mean. Significant differences ($p < 0.05$) were calculated using Duncan's multiple range test, followed the method reported by Steel and Torrie, (1980).

3. Results and discussion

3.1. Chemical composition

Chemical composition and caloric value of the new Siwe date products were determined and the obtained results are tabulated in table 2.

Table 2: Chemical composition and caloric value of new Siwe date products

	Coconut	Cinnamon	Coffee	LSD
Moisture (%)	13.18^{a}	13.51^{a}	13.75^{a}	0.650
Protein (%)	4.66^{a}	3.13^{b}	3.33^{b}	0.244
Lipids (%)	12.17^{a}	9.60^{b}	9.38^{b}	0.257
Ash (%)	1.80^{a}	1.90^{a}	1.95^{a}	0.170
Crude fiber (%)	2.21^{b}	2.52^{a}	2.01^{c}	0.117
Carbohydrates (%)	66.01^{b}	69.34^{a}	69.58^{a}	0.546
Polyphenols (mg GAE/100g)	361.96^{c}	473.38^{b}	556.25^{a}	12.234
Flavonoids (mg QE/100g)	92.15^{c}	119.32^{b}	165.65^{a}	4.005
Caloric value (Kcal/100g)	400.461^{a}	384.947^{b}	384.757^{b}	7.344

Means (+SD) in the same row with different superscripts are significantly different ($p < 0.05$)

The presented data in table 2, showed obviously that, the highest contents of protein and lipids (4.66 and 12.17 %, respectively) as well as Caloric value (400.461 Kcal/100g) were recorded for the filled date with coconut paste. This may be due to the higher protein and lipid contents of whole milk. While there are no significant differences between the filled date with Cinnamon paste and the filled date with coffee paste in protein, lipids and ash contents. Concerning to crude fiber results in the same table, it could be noticed that date sample filled with cinnamon paste had the highest crude fiber content

(2.52%) followed by date sample filled with coconut paste (2.21%), then date sample filled with coffee paste (2.01%), these could be attributed to variation between filling materials in crude fiber contents.

A high level of fiber intake has health-protective effects and disease-reversal benefits. Where, Increasing the high fiber foods intake or fiber supplemented food improves blood glucose control and serum lipoprotein values, lower Cardiovascular and blood pressure disease, associates weight loss, and improves regularity (Ötles and Ozgoz, 2014).

Regarding to polyphenol and flavonoid contents in the same table, it could be noticed that, coffee filled dates possessed the highest polyphenol and flavonoid contents (556.25 mg GAE/100g and 165.65mg QE/100g, respectively), followed by cinnamon filled dates (473.38 mg GAE/100g and 119.32 mg QE/100g, respectively), then coconut filled dates (361.96 mg GAE/100g and 92.15 mg QE/100g, respectively).

3.2. Minerals contents

Mineral contents and their daily value (% of Recommended Daily Intake) of new Siwe date products were estimated and the results are presented in Table 3.

Table 3: Minerals contents (mg/100g) and daily value (% of RDI) of new Siwe date products

	RDI* mg/day	Date filled by coconut paste		Date filled by cinnamon paste		Date filled by coffee paste	
		Content	Daily value (%)	Content	Daily value (%)	Content	Daily value (%)
Ca	1000	160.54	16.054	96.46	9.646	69.74	6.974
Fe	13.7	36.0	262.77	29.04	211.97	43.0	313.86
Mg	420	55.82	13.29	46.22	11.00	43.76	10.41
Cu	0.900	3.084	342.66	0.662	73.55	1.734	192.66
Mn	2.3	2.618	113.82	0.994	43.21	2.304	100.17
Zn	7	1.154	16.48	1.074	15.34	0.674	9.62
Na	1500	40.0	2.66	20.0	1.33	20.0	1.33
K	4700	100.0	2.12	80.0	1.70	80.0	1.70

***** RDI: Recommended Daily Intake (WHO/UNICEF, 1998).

The mentioned data illustrated that, calcium contents ranged between 69.74 and 160.54 mg/100g, these represent daily values between 6.974 and 16.054%. Also, the magnesium contents ranged from 43.76 to 55.86 mg/100g, which represent daily value between 10.41 and 13.29%. Magnesium is an important mineral in the regulation of blood pressure. It was observed that magnesium intake from foods inversely related to blood pressure compared to intake from supplements (Champagne, 2008). The highest quantile (median intake = 457 mg/day) of magnesium intake in Health Professionals Follow-up Study was associated with reduced risk of developing cardiovascular disease compared to lowest quantile (median = 269 mg/day) (Al-Delaimy *et al.,* 2004). Magnesium was also found to be positively associated with insulin sensitivity in Insulin Resistance Atherosclerosis Study (Ma *et al.,* 2006).

From the presented results it could be noticed that, coconut filled date sample had the highest contents of all determined minerals comparing with cinnamon and coffee filled date samples with one exception related to iron content, where coffee paste filled date recorded the highest iron content 43 mg/100g. Also, the mentioned data demonstrated that, all produced new Siwe date products had iron content more than the recommended daily intake where the daily value ranged between 211.97 % and 313.86%. On the other hand, both of coconut and coffee filled date samples possessed higher contents of copper (3.084 and 1.734 mg/100g, respectively) and manganese (2.618 and 2.304 mg/100g, respectively) than those of the recommended daily intake (0.9 and 2.3 mg/day, respectively).
These three minerals have important roles for human health as follow:

- Iron deficiency is related to development of severe anemia, reduced cognitive function (Grantham-McGregor and Ani, 2001) as well as raised the lead poisoning risk (Wright, 1999). Low concentration of iron in the brain is also related to raising the appearance of restless legs syndrome (Allen *et al.,* 2001).

- Copper is notedness to have a noticeable role in developing and maintaining the immune system function and osteoporosis (Eaton-Evans *et al.,* 1996).
- Manganese, like other minerals, helps in the prevention of osteoporosis (Strause *et al.,* 1994).
- Also, Zn is a savvied essential trace element for immunity as a cofactor of thymulin (Baudry *et al.,* 2020).

3.3. Phenolic compounds

Phenolic compounds of new Siwe date products were determined and the obtained results are tabulated in Table 4.

Phenolic acids have earned attention as a result of their possible protection effect against oxidative damage diseases, like cancers, stroke and coronary heart diseases (Robbins *et al.,* 2003). In addition, their possible interest for human health goes far above their protective antioxidant behavior.

Table 4: Phenolic compounds of new Siwe date products

	Date filled by coconut paste	Date filled by cinnamon paste	Date filled by coffee paste
Gallic acid	819.68	855.46	787.76
Chlorogenic acid	12.08	ND	378.88
Catechin	35.21	35.11	202.02
Methyl gallate	2.84	9.97	59.49
Caffeic acid	ND	3.72	ND
Syringic acid	1.34	ND	256.80
Coumaric acid	2.09	3.08	35.34
Vanillin	ND	ND	59.87
Ferulic acid	102.15	202.82	1182.06
Naringenin	49.3	81.6	1689.29
Daidzein	114.28	103.29	45.34
Quercetin	277.84	312.08	2253.00
Cinnamic acid	ND	4.21	23.84
Apigenin	ND	ND	463.99
Kaempferol	ND	ND	791.15

From the presented data, it could be observed that, the predominant phenolic acids for coconut and cinnamon filled dates are Gallic acid (819.68 and 855.46 ppm, respectively) followed by ferulic acid (102.15 and 202.82 ppm, respectively), while, opposite situation was observed for coffee filled date, where ferulic acid was the predominant phenolic acid (1182.06 ppm) followed by Gallic acid (787.76 ppm).

Ferulic acid is an overgrowing component in treating or alternative therapy of lipid and glucose metabolic disorders. Ferulic acid possessed varied pharmacological effects, as anti-inflammatory, antioxidant, anticarcinogenic and antifibrosis effects (Li *et al.,* 2021). Ferulic acid is implicated in treating of several diseases, as pulmonary, diabetes, cancer and cardiovascular diseases (Kumar and Pruthi, 2014).

The presented data in the same table illustrated that, the predominant flavonoids for coconut and cinnamon filled dates are Quercetin (277.84 and 312.08 ppm, respectively), followed by daidzein (114.28 and 103.29 ppm, respectively), then naringenin (49.3 and 81.6 ppm, respectively). Whereas, the predominant flavonoids for coffee filled date are Quercetin (2253 ppm) followed by Naringenin (1689.29 ppm) then Kaempferol (791.15 ppm).

Phytoestrogens are categorized to three major groups: isoflavones (genistein, daidzein, glycitein or equol), lignans (enterolactone or enterodiol) and coumestans (coumestrol). They have a structure similar to that of estradiol, and may act in the body either with estrogenic or antiestrogenic effects (Knight and Eden, 1996; Wade *et al.,* 1999 and Zava *et al.,* 1998). They act as natural selective estrogen receptor modulators (SERMs), and bind to certain estrogen receptors in some tissues, either activating

or down-regulating cellular responses. The role of phytoestrogens in cancer includes a preventive action, a cancer cell proliferation inhibiting factor and a therapy aid.

The inhibition effect of quercetin against cardiovascular diseases may be largely assumed to its antioxidant and anti-inflammatory activities. The regular consumption of flavonoids in flavonoid rich foods results in a useful effect on human health, especially lowering the death risk of coronary heart disease (Hertog *et al.,* 1993 and Hertog *et al.,* 1995). Anti-carcinogenesis activities of quercetin led to include it as a natural chemo-preventive agent and acts though varied biochemical, genetic and immunological sides related to tumors (Russo *et al.,* 2012).

Also, kaempferol protects brain cells against the toxic effects of beta-amiloyd in patients with Alzheimer's disease (AD)

The tabulated data in Table 4, demonstrated that, coffee filled dates had higher contents of all studied phenolic compounds comparing to coconut and cinnamon filled dates with three exceptions related to gallic acid, caffeic acid and daidzein. These results are in agreement with those reported by Acosta-Otálvaro *et al.* (2021) who reported that, phenolic acids increased by increasing the coffee percentage in cocoa-coffee mixture.

3.4. Microbiological quality

Concerning the microbiological quality of the studied new date products, total bacterial count and mold and yeast counts were examined and the obtained results were presented in Table (5). From the presented data, it could be observed that, both of cinnamon and coffee treatments led to improve the microbial quality of the new products comparing with coconut filled sample, by reducing both of total bacterial count and mold and yeast count. But the highest positive effect was recorded for coffee filled date. These could be due to the higher contents of phenolic compounds.

Table 5: Total bacterial and mold and yeast counts of new Siwe date products

	Total count (cfu/g)	Mold and yeast (cfu/g)
Date filled by coconut paste	$8 \times 10^{2\ a}$	$10 \times 10^{2\ a}$
Date filled by cinnamon paste	$5\times 10^{2\ b}$	$7 \times 10^{2\ b}$
Date filled by coffee paste	$1 \times 10^{2\ c}$	$3 \times 10^{2\ c}$
LSD	2.266	2.444

Means (+SD) in the same column with different superscripts are significantly different ($p < 0.05$)

3.5. Sensory evaluation

Sensory evaluation of the new Siwe date products was achieved and the obtained results are presented in Table 6. The mentioned data in table 6, obviously demonstrated that, the highest values of all studied sensory parameters were recorded for coconut filled date fruits. From the same table it could be concluded that, all new date products are highly accepted organoleptically, where the obtained scores were ranged from 6.36 to 6.59 for taste, 6.46 to 6.59 for odor, 6.58 to 6.71 for texture, 6.5 to 6.68 for outer appearance, 6.56 to 6.62 for internal appearance and 6.37 to 6.66 for overall acceptability.

Table 6: Sensory evaluation of new Siwe date products

	Taste (7)	Odor (7)	Texture (7)	Outer appearance (7)	Internal appearance (7)	Overall acceptability (7)
Date filled by coconut paste	6.59^{a}	6.59^{a}	6.68^{a}	6.68^{a}	6.62^{a}	6.66^{a}
Date filled by cinnamon paste	6.36^{b}	6.50^{b}	6.71^{a}	6.50^{b}	6.56^{a}	6.37^{c}
Date filled by coffee paste	6.50^{a}	6.46^{b}	6.58^{b}	6.62^{a}	6.58^{a}	6.57^{b}
LSD	0.090	0.069	0.039	0.068	0.069	0.013

Means (+SD) in the same column with different superscripts are significantly different ($p < 0.05$)

4. Conclusion

The obtained results demonstrated that, the highest protein and lipids content and Caloric value were recorded for coconut filled date, while date sample filled with cinnamon paste had the highest crude fiber content. On the other hand, coffee filled dates possessed the highest polyphenol and flavonoid contents. All new date products had iron content more than the recommended daily intake. In addition, both of coconut and coffee filled date samples possessed higher contents of copper and manganese than those of the recommended daily intake. The predominant phenolic acids for coconut and cinnamon filled dates are Gallic acid followed by ferulic acid, while, opposite situation was observed for coffee filled date, where ferulic acid was the predominant phenolic acid followed by Gallic acid. The predominant flavonoids for coconut and cinnamon filled dates are Quercetin, followed by daidzein, then naringenin. Whereas, the predominant flavonoids for coffee filled date are Quercetin followed by Naringenin then Kaempferol. Both of cinnamon and coffee treatments led to improve the microbial quality of the new products comparing with coconut filled sample. In the same time, all new date products are highly accepted organoleptically.

In conclusion, the results of the current study suggested that, the prepared products are good sources of functional ingredients, such crude fiber, some minerals (Fe, Cu and Mn) and bioactive compounds such as phenolic and flavonoids with potentially desirable effects on human health.

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