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FOOD SCIENCE & TECHNOLOGY | REVIEW ARTICLE

A review of the chemical composition, nutritional and health benefits of dates for their potential use in energy nutrition bars for athletes

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Abstract: The purpose of this review was to provide information about the chemical composition and nutritional benefits of date fruits, known more commonly as dates. We also present the potential application of dates in energy nutrition bars for athletes. Dates have a high nutritional value and are rich in carbohydrates, dietary fibers, proteins, minerals, and many vitamins including B complex. Carbohydrates comprise 70% of dates mainly as fructose and glucose. In addition, dates are rich in calcium, iron, magnesium, selenium, copper, phosphorus, potassium, zinc, sulfur, cobalt, fluorine, and manganese. Recently, there has been enhanced interest in the abundant health-promoting properties of dates, and this has led to the need to develop food products that use dates as a rich source of nutrients. Dates thus have a great potential for application as a food ingredient in dietary supplements, energy nutrition bars and as a functional food for athletes.

Subjects: Food Additives & Ingredients; Food Chemistry; Food Engineering

Keywords: date palm fruit; chemical composition; functional food; athletes; energy; nutrition; human health

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ABOUT THE AUTHOR

Amira A. Ayad is a research scientist at the North Carolina Research Campus in Kannapolis, NC. She holds a PhD in food science and technology with a concentration in the area of fermentation and probiotics formulation. Recently, Dr Ayad has been working on the application of date fruit to different formulations and product development. Dr Ayad is part of a research team that study functional and natural compounds in order to address issues related to food safety and functional foods. For example; many natural compounds have either antimicrobial activity or growth-promoting factors for bifidobacteria and lactic acid bacteria. For example, date fruits are rich in many compounds that enhance food safety and promote the health of human gut microbiota. Therefore, in this work, we focused on the incorporation of date fruits into an energy nutrition bar for athletes.

PUBLIC INTEREST STATEMENT

In this review, we shared the information about the chemical composition and the health benefits of the date fruits. We also introduce the potential application of dates in energy nutrition bars for athletes. Dates have high nutritional value and are rich in carbohydrates (fructose, glucose, and source), dietary fibers, proteins, minerals such as calcium, iron, magnesium, selenium, copper, phosphorus, potassium, zinc, sulfur, cobalt, fluorine, and manganese, and many vitamins including B complex. Recently, enhanced interest in the health-promoting properties of dates has led to the need to develop new food products using date fruits as a rich source of nutrients. Dates have great potential for application as a food ingredient in many dietary supplements and as a functional food for athletes. We demonstrated that date fruits in energy nutrition bars had a positive acceptability and sensory attributes along with high nutritional value.

1. Introduction

Athletes around the world depend on adequate nutrition for performance and endurance. Consequently, the need for energy balance and efficient body metabolism cannot be overemphasized. Such a diet should also be able to enhance the basal metabolism of athletes. The quest for good nutrition is thus paramount as it serves as a bedrock for a balance of both macro- and micronutrients. One easily accessible source of nutrition for athletes is the nutrition bar. A nutrition bar is defined as a category of dietary food supplement in the shape of a bar that is comprised of proteins, carbohydrates, fats as well as vitamins and minerals and fulfills the purpose of an energy booster (Rajabi, 2017). An energy bar is fundamentally synonymous with a nutrition bar and is defined as a convenient, ready-to-eat, bar-shaped food that serves as an energy booster, and generally contains fats, carbohydrates, proteins, vitamins and minerals as major ingredients (Lotz, 2016). Thus, the terms nutrition and energy bars will be used synonymously and represent the same idea throughout this review. Energy bars are nutritious snack foods that are enjoyed by most active individuals including athletes. Energy bars are also an excellent source of proteins and natural sugars (carbohydrates) which are nutritionally balanced to enhance performance. In addition to providing energy, the protein content in energy bars helps to build muscle mass and protects tissues.

Dates are a natural reservoir of sugars including sucrose, fructose, and glucose which comprise two-thirds of the total date flesh. One hundred grams of fresh dates contain approximately 157 calories of energy, whereas dry dates contain more than 300 calories of energy per 100 grams (Habib et al., 2014). In addition to their high natural sugar content, dates also possess additional nutritive components in the form of proteins, crude fiber, fats, and antioxidants thus making dates a functional food with significant health benefits (Arshad et al., 2019). An energy nutrition bar comprised dates, probiotics, and other high-end carbohydrates and protein sources could thus potentially boost energy, enhance performance and also support the immune system of athletes by augmenting the natural flora in the gastrointestinal tract. The objective of this report, therefore, was to review the chemical composition, nutritional value and health benefits of dates and to present the potential use of dates in an energy nutrition bar for athletes (Alla & Jithendran, 2018).

2. Chemical and nutritive composition of dates

Dates are very sweet and contain about 50–88% of the total weight based on the cultivar type, the ripening stage, and the total moisture content. Fructose and glucose are the primary sugars in dates and usually comprise two-thirds of the total date flesh, with one-fifth of the total fleshy composition consisting of water and a small remaining portion of dietary fiber. Other rich components of dates include protein, fats, crude fiber, minerals, vitamins (especially vitamin B), and tannins (Marzouk & Kassem, 2011; Vayalil, 2012). Dates possess very high nutritive value and can thus play an effective role in helping to meet human nutritional needs. Table 1 illustrates the general composition of the dried date fruit (Ahmed et al., 2014; Assirey, 2015; Borchani et al., 2010; Punia, 2016).

The flesh of dates contains between 0.2% and 0.5% oil compared to 7.7–9.7% in the seed or pit, and palmitoleic, oleic, linoleic, and linolenic acids are the major unsaturated fatty acids. Date seeds could be used as a potential source of oleic acid as the oleic acid content of the seeds varies between 41.1% and 58.8%. The protein in dates contains 23 (Fadel, 2008) different types of amino acids, some of which are non-existent in popular fruits such as oranges, peaches, grapes, and apples. Dates contain at least six vitamins including a small amount of vitamin C plus vitamin B(1) thiamine, B(2) riboflavin, nicotinic acid (niacin) and vitamin A. The essential nutrients in dates thus make this as an ideal food, providing a wide array of nutrients for human health (Baliga et al., 2011).

2.1. Carbohydrates

The major chemical constituents of dates are carbohydrates, which include reducing sugars such as glucose and fructose as well as non-reducing sugars such as sucrose and small amounts of

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Table 1. Proximate composition of dried dates

Date Variety	Total Sugars (g/100 g)	Protein (g/100 g)	Fat (g/100 g)	Ash (g/100 g)	Calcium (mg/100 g)	Potassium (mg/100 g)	Sodium (mg/100 g)	Magnesium (mg/100 g)	Phosphorus (mg/100 g)	Moisture (g/ 100 g)
Ajwa	**74.3**	**2.91**	**0.47**	**3.43**	**187**	**476.3**	**7.5**	**150**	**27**	**22.8**
Medjool	66.47	1.81	0.39	1.74	64	696	1	54	62	21.32
Deglet Noor	86.42	1.71	0.40	1.78	25.05	774.71	5.79	50.26	-	13.50
Dabbas	-	2.54	0.41	1.64	35.71	419.05	14.38	42.17	48.36	19.5
Barhi	-	2.3	0.10	1.40	12	855	75	82	-	29.5

polysaccharides such as cellulose and starch (Baliga et al., 2011). The level of sucrose is higher in dried dates than in soft dates. Polysaccharides in the date flesh and seeds or pits contain xylose, arabinose, glucose, and galactose (Shafiei et al., 2010). Semi-dry dates have nearly 50% each of sucrose and reducing sugars (Hassan et al., 2017) and contain more sucrose than reducing sugars (Djaoud et al., 2019). Dry dates with solid and dry flesh contain relatively more sucrose than reducing sugars. In general, there are two types of dates, sucrose-containing dates or reducing sugar-containing dates. The composition of sugars (sucrose, glucose, and fructose) along with the glucose to fructose ratio (G/F) in some selected date varieties in the UAE are summarized in Table 2. The moisture content of dates is indirectly proportional to their sugar content, which indicates that dates with high moisture content are always lower in sugars. Dates from Saudi Arabia contain about 70% reducing sugars with almost equal quantities of both glucose and fructose (Assirey, 2015; Hamad et al., 2015). The most important commercial characteristics of dates are based on the sugar content which is significant for both fresh consumption and fruit processing (Fadel, 2008). Dates contain a relatively high sugar content and could thus be a potential source of refined sugar.

2.2. Protein

The protein content of dates ranges from 1% to 7% and includes essential amino acids required for the metabolic functioning of the human body. Date proteins contain 23 different types of amino acids, some of which are not present in popular fruits such as oranges, apples, and bananas. Most date cultivars contain the following amino acids: lysine, histidine, arginine, aspartic acid, threonine, glutamic acid, serine, proline, glycine, alanine, cystine, valine, methionine, isoleucine, leucine, tyrosine, and phenylalanine (Ardekani et al., 2010). (Tang et al., 2013) also reported that glutamic and aspartic acid make up the highest amino acid quantities in dates. Dates are also rich in acidic amino acids such as glutamic acid and low in sulfur-containing amino acids such as cysteine (Ahmed et al., 2014). The molecular weight of date proteins varies from 12,000 to 72,000 daltons. Most date proteins are water-soluble albumins. Dates grown in Middle Eastern countries such as Saudi Arabia, Jordan, Oman, and Iran have very similar protein profiles and contain complex protein mixtures, whereas some varieties grown in the US typically have very low protein content (Ahmed et al., 2014).

2.3. Fat content

Dates typically contain little fat, with most of the fat concentrated in the crust. The fat content in the flesh ranges between 0.1% and 0.5%, and fat plays an essential role in the protection of the fruit more than in the nutritional value of the date flesh. The major saturated fatty acids in dates

Table 2. Sugar composition of selected date varieties in UAE (g/100 g of fruit flesh) (Ahmed et al., 2014; Assirey, 2015)

Date Variety	Glucose (G)*	Fructose (F)*	G/F ratio	Sucrose*
Barhe	34.6 ± 0.1	39.3 ± 0.2	0.88	4.2 ± 0.1
Bumaan	32.3 ± 0.1	34.8 ± 0.1	0.93	4.4 ± 0.3
Dabbas	36.3 ± 0.5	35 ± 0.2	1.04	6.4 ± 0.7
Fard	31.3 ± 0.2	32.1 ± 0.2	0.98	5.2 ± 0.2
Jabri	35.2 ± 0.2	35.6 ± 0.3	0.99	5.8 ± 0.1
Khalas	33.4 ± 0.3	33.2 ± 0.1	1.01	6.1 ± 0.5
Lulu	40.2 ± 0.5	35.5 ± 0.1	1.13	6.7 ± 0.3
Maktoomi	47.4 ± 0.4	35.7 ± 0.2	1.33	6.9 ± 0.1
Raziz	31.8 ± 0.7	33.9 ± 0.1	0.94	4.5 ± 0.1
Shikat	35.1 ± 0.4	36.6 ± 0.3	0.96	4.9 ± 0.2
Shishi	33.7 ± 0.2	34.3 ± 0.2	0.98	5.5 ± 0.6

include lauric, myristic, and palmitic acids, while the major unsaturated fatty acid is oleic acid. Other fatty acids in minor quantities include capric, caprylic, stearic, margaric, arachidic, linoleic, and pelargonic (Baliga et al., 2011).

2.4. Crude fiber

The daily consumption of 100 g of dates provides approximately 50–100% of the recommended daily amount of fiber. The insoluble part of date fiber is comprised of cellulose, hemicellulose, lignin, and lignocellulose. The quantities of cellulose, hemicellulose, and lignin of date flesh are 1.55%, 1.28%, and 2.01%, respectively. The crude fiber content of dates is not a good indication of the total dietary fiber content since the fiber also contains pectin, hemicellulose, cellulose, gums, mucilages, starch, and lignin depending on the stage of maturity. The total dietary fiber content of dates varies from 6.26 to 8.44 g/100 g, of which 84–94% is insoluble fiber (Masmoudi et al., 2010). However, other studies have shown that dates contain between 6.4% and 11.5% dietary fiber depending on the various type and the stage of ripening. Dates also contain a special type of fiber known as *β*-D-glucan which has been confirmed to have high anticancer activity. These polysaccharides have the main chain of (1→3)-*β*-D-glucopyranosyl residues with (1→6)-linked branched saccharide residues (Elleuch et al., 2011).

Date crude fiber plays an important role in date processing as it indirectly affects the yield in liquid date sugar production. The higher the crude fiber and moisture content, the less the yield during the production of liquid date sugar. During the production of date syrup and its storage, pectin causes gelation, which results in lower liquid sugar yields (Guido et al., 2011). However, this situation is eliminated by pre-treatment of the extracted juice with pectinase (Amanat et al., 2012). The concentrations of dietary fiber in dates play major roles in functional properties such as high water-holding capacity, high oil-holding capacity, gel formation, and behavior in emulsions and suspensions (Elleuch et al., 2008). These characteristics are important to the food industry as dietary fiber could also be used as an ingredient in dairy, meat, bakery products, and jam and modify their textural properties, avoid syneresis, and stabilize high-fat content and emulsions (Elleuch et al., 2011).

2.5. Minerals and vitamins

Dates are a rich source of vitamins and minerals and contain at least 15 (Sablani et al., 2008) different minerals such as magnesium, manganese, phosphorus, iron, calcium, potassium, sodium, and zinc. The percentage of each mineral in dried dates varies between 0.1 and 916 mg/100 g of date flesh (Agoudjil et al., 2011; Ayad, 2016). Dates also have high levels of copper, selenium, potassium and magnesium, average concentrations of manganese, iron, phosphorus, cobalt, fluorine, zinc, and calcium, as well as small quantities of boron (Agoudjil et al., 2011). In many date varieties, the potassium content in the flesh can be as high as 0.9%, while some seeds could have as much as 0.5%. Potassium is considered to be the predominant microelement in the date flesh, whereas the phosphorous content is less than that of the other macro-elements (Assirey, 2015; Mirghani, 2012).

The micro-elements zinc and copper are found in low concentrations in dates, whereas iron is present in higher concentrations (Assirey, 2015). The high potassium and low sodium content in dates are beneficial for people suffering from hypertension. Boron is very useful in the treatment of brain cancer and, in conjunction with other vitamins, is also used in the treatment of rheumatism (Vayalil, 2012). The abundance of fluorine present in dates is useful for the prevention of tooth decay. Moreover, the selenium content of dates can help to prevent cancer and strengthen the human immune system. According to a previous study, the amount of selenium in some date varieties is in the range of 1.48–2.96 µg/g (Vayalil, 2012). Dates could be used as iron deficiency supplements without causing side effects such as nausea, headache, and anorexia that can occur with the use of conventional iron supplements. Dates are also a good source of vitamins compared to other dried fruits (US Department of Agriculture, A. R. S, 2011). In addition, fresh dates contain higher concentrations of vitamins than dried dates as a result of the depletion of

vitamins during the drying process. Thiamin, riboflavin, niacin, ascorbic acid, pyridoxine, and vitamin A are present in dried dates in relatively low concentrations (Hamad et al., 2015; Hassan et al., 2017).

2.6. Antioxidants

Dates contain a wide range of phytochemicals that are known for their antioxidant capacity. Some of these phytochemicals are carotenoids (beta-carotene, lycopene, lutein, zeaxanthin, and neoxanthin), the phenolics; the cinnamic acids and their derivatives (ferulic, sinapic, syringic, vanillic, gallic, caffeic, protocatechuic, coumaric acids, and their derivatives such as dactilyferic acids, etc.), flavonoid glycosides (luteolin, methyl luteolin, quercetin, and methyl quercetin) flavones, flavonols (catechin, epicatechin), flavoxanthin, anthocyanins, and so on as seen in Table 3 (Al-Farsi et al., 2005; Biglari et al., 2008; Ghnimi et al., 2017; Shahidi & Naczk, 2003).

The concentration of these phytochemicals in dates usually decreases as the fruit reaches maturity. Phenolic compounds and carotenoids (flavonoids and anthocyanins) can contribute to varying degrees of antioxidant and antimutagenic activity. The total phenolic compounds in dates have greater antioxidant activity than that of ascorbic acid (Shivashankara et al., 2004). Many research studies have confirmed the free radical scavenging properties of dates as well as date juice extracts. Most of the antioxidants in dates are known as hydrophilic or water-soluble compounds (Al-Farsi et al., 2005). These compounds are also a major factor in the flavor and colors of different dates due to variations in the content of active phenolic acids. (Al-Farsi & Lee, 2008; Allaith, 2008; Biglari et al., 2008; Elleuch et al., 2008).

3. Date bars in sports nutrition

3.1. The potential use of energy bars in sports nutrition

According to the FDA, energy bars can be classified as dietary supplements and are usually consumed by athletes and other physically active people in order to support their calorific needs

Table 3. Major phytochemical compounds in dates (Biglari et al., 2008; Ghnimi et al., 2017)

Class	Compounds
Benzoic acid and derivatives	Gallic acid, protocatechuic acid, p-hydroxybenzoic acid, vanillic acid, syringic acid, sinapic acid
Cinnamic acid and derivatives	Caffeic acid, hydrocaffeic acid, ferulic acid, p-coumaric acid, syringic acid, dactyliferic acid, 2 caffeoylshikimic acid hexoside, 3-caffeoylshikimic acid, 4-caffeoylshikimic acid, 5-caffeoylshikimic acid, caffeoylsinapoyl hexoside, and dicaffeoylsinapoyl hexoside
Flavonoid glycosides and esters	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
Flavan-3-ols	(+)-catechin, and (−)-epicatechin
Proanthocyanidins	Procyanidin oligomers based on (−)-epicatechin including procyanidin B1, procyanidin B2, procyanidin trimer, procyanidin tetramer, procyanidin pentamer, and procyanidin polymers based on (−)-epicatechin (decamers to heptadecamers)
Anthocyanins	Cyanidin (in some dark varieties)

(Norajit et al., 2011). Energy bars also help to provide the strength and vitality for sustained physical and mental activity and are typically high in carbohydrates and moderate in protein content (Alla & Jithendran, 2018). Energy bars are globally known as a convenient ready -to- eat food that does not require any preparation and can be easily stored at room temperature. They have a balanced nutritional profile meeting both macro and micronutrient requirements for enhanced body metabolism (Ryland et al., 2010). Fruit-based bars can serve as energy bars as they are an exceptional source of superior nutritive, natural sugars and bioactive elements that provide the energy required to meet the recommended daily nutritional intake (Parn et al., 2015).

Dates are a good source of carbohydrates in the form of sugars that comprise about 78% of the whole fruit. This reservoir of natural sugars is readily provided to the human body as a source of energy (El Arem et al., 2013). Date consumption also provides consumers with therapeutic benefits and nutrition that are vital for the proper functioning of the human body. The fruit is either consumed directly (fresh or in dried form) or is converted into products such as date paste and syrup (Tang et al., 2013). Dates provide antioxidant, anti-inflammatory, gastrointestinal-protection, and anticancer properties that are vital for human health (Tang et al., 2013). In addition, consumption of dates could help to reduce and control diabetes mellitus and other cardio-and cerebrovascular diseases (CCVD) (Tang et al., 2013). Therefore, date bars are a better alternative to direct consumption of dates fruit, especially when geared toward energy provision for athletes (Nadeem et al., 2012; Parn et al., 2015; Shaheen et al., 2013).

One common goal for all athletes is to balance energy intake with energy expenditure in order to prevent an energy deficit or excess (Meyer et al., 2007). One food source that contains appropriate amounts of both macro- and micronutrients is essential for the energy and nutrition needs of athletes. Dates could fulfill these nutrition requirements for athletes and enhance their performance by reducing fatigue and the risk of injury and recovery (Ghazal et al., 2016; Hoch et al., 2008).

3.2. Application of dates in energy nutrition bars for athletes

Dates are rich in natural sugars and other nutrients and are thus a good energy source as well as a functional food to address issues related to health (Ayad et al., 2020). Dates can provide substantial energy when used as a complementary ingredient in energy nutrition bars and are classified as functional foods because they are rich in antioxidants, vitamins, minerals, and other major macronutrients. In addition, dates have a unique texture that blends well with other ingredients in the formulation of date bars (Agoudjil et al., 2011). Energy nutrition bars can provide this benefit for athletes partaking in endurance, all day tournaments or competitions, and intense work out sessions (Al-Alawi et al., 2017). The macronutrient composition of dates (high in carbohydrates and low in protein and fat) provides a versatile base in energy nutrition bars for athletes to use prior to activity, during endurance activity and coupled with whey protein as an excellent nutritional recovery product. In addition, date nutrition bars could provide sufficient energy for athletes in the form of readily digestible nutrients allowing for sustained activity and recovery as well as serve as a natural alternative source of energy for their bodies (Burke et al., 2011).

3.3. Date nutrition bar for athletes

A novel nutrition bar specifically targeted at the health and well-being of athletes was developed by our research team in the Food Microbiology and Biotechnology Laboratory at North Carolina A&T State University. Our team developed this bar using dates as a base ingredient for the bar based on previous work that demonstrated that dates can significantly impact the growth and functionality of human microbiota including lactobacillus and indirectly improve health (Ayad et al., 2016; Mjalli et al., 2019). The ingredients for our nutrition bar include pitted soft dates, complementary ingredients such as gluten-free oats, powdered whole grains, a protein source (preferably powdered milk or whey protein), and other nutrient-rich materials. The inclusion of oats in the ingredient list enhanced the nutritional and sensory characteristics of the final product (Munir et al., 2018). The product formulation was developed by modifying the procedure used by Aljaloud, Colleran, & Ibrahim (2020). The oats were finely blended in a food processor until

a smooth particle size similar to the texture of flour was obtained. The pitted dates and all other ingredients were added to the oats and mixed until a homogeneous consistency was reached. The resulting mixture was then transferred to a flat pan lined with a baking sheet and hand pressed and firmly molded ensuring a smooth and even top layer. The pan was placed in the oven at 250°C for 5 minutes and rapidly cooled in the refrigerator at 4°C for 30 minutes. The bars were removed from the pan and sliced into equal-sized rectangular bars. The bars can be coated with other ingredients such as almonds, sesame seeds, hazelnuts, sunflower seeds, chia seeds, etc., as seen in Figure 1.

A preliminary microbiological analysis of the date nutrition bars indicated that they were free of common foodborne pathogens such as *E. coli*, *Salmonella*, *Staphylococcus aureus*, and *Listeria*. Microbiological analysis was also conducted during storage at ambient (23°C) and refrigerated temperatures (4°C) in order to determine the population of total aerobic bacteria and yeast and mold. The results showed that during storage, the bacterial counts for total aerobic bacteria and yeast and mold in all samples remained below 3.50 Log CFU/g. The water activity ranged between 0.62 and 0.73 based on the ingredients used. Our results are in agreement with those of another recently published work (Munir et al., 2018) in which date bars had a low water activity between 0.5 and 0.6, and the products had a stable microbial quality and stable shelf life. Overall, our preliminary data suggest that the date nutrition bars are safe and stable and can, therefore, be classified as a ready-to-eat snack.

4. Conclusion

In this paper, we reviewed the chemical and nutritional value of dates along with their health benefits and discussed the potential use of dates in an energy nutrition bar for athletics. We also demonstrated that the addition of dates to energy nutrition bars resulted in a positive effect on consumer acceptability and liking as well as good sensory attribute ratings and high nutritional value. The dates in our energy nutrition bars contain high natural sugars, fiber, and minerals content with a deliciously sweet taste in addition to other nutrients needed by athletes. Moreover, due to their abundance of natural sugars, dates are an essential ingredient in the preparation of energy nutrition bars in order to provide the needed energy for physically active individuals. Our energy nutrition bars could thus be used as an alternative to traditional nutrition bars and snacks that are currently available in the market. Our newly developed bar thus has the potential to be marketed as a nutritional fruit bar, ready-to-eat snack, or dessert, and it would also help food manufacturers and processors to think about nutrition ingredients from a different perspective. Further work is currently underway in our laboratory to optimize and standardize the processing steps in order to ensure consistency with the final energy nutrition bars. Additional work is also needed in order to determine consumer acceptability of different flavors (such as rose water, lemon, ginger, green tea, mint) in order to provide consumers with a wider range of product

Figure 1. Date nutrition bars with different formulations and coating ingredients.

choices. It is also important to conduct additional work on the shelf-life stability of this new product in order to ensure safety and the highest quality.

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Competing Interests
The authors no competing interests.

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