

Date Palm Seeds: An Agro-waste Product used as a Caffeine Free Functional Beverage

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ABSTRACT

Date palm fruits are one of the holy foods. They are generally consumed in fresh form. Traditionally it is considered very sacred and also known for its nutritional abundance. Along with fruit, the date pit is also significantly nutritious and rich in dietary fibre, however the date pits are discarded without using them further as they are considered as agro-waste and its disposal is a huge economical loss. To utilize these date pits, there have been several recent ongoing studies on date pit by-products and its impact on health. This review paper is an attempt to understand how date fruits can be a super food in the present scenario and also the need to utilize the date palm seeds. There is great potential of date palm seeds as it is possessed with great amount of nutrients, functional properties, phenolic compounds, antioxidants and bioactive compounds. For a healthy and sustainable life, several researches and studies have been carried out for developing various products using date palm seeds as the major source. Among all of the researches, this paper focuses to review on the caffeine free functional beverage made from date pits following different processing methods, its composition and sensory evaluation. The paper also includes other functional food applications and health benefits provided by the date palm seeds.

Keywords: *Agro-waste, Antioxidants, Caffeine free, Date seeds or pits, Dietary fibre, Functional Food, Phenolic Compounds.*

1. Introduction

In the present era, people are cautious regarding their diet and lifestyle as there are various diseases and disorders which affect human physical and mental health. Every household and every individual is choosing health and quality above all. Incorporating functional foods is the most popular and emerging solution for all the health issues. Functional foods are not definite to particular class of food; every food has functional properties which promotes human health significantly.

Nature provides a wide range of foods for human consumption. Among all the available edible foods, fruits play a vital role due to the presence of

health promoting and functional compounds present in them. All the fruits, vegetables and naturally occurring foods have both edible and inedible portions. The inedible portions of the fruits are often considered as seeds, pits or roots. These inedible portions of the fruits are mostly produced in fruit processing industries and they are generally disposed of in the environment. These fruit seeds are referred as agro-waste. Wastage of agro-waste not only causes pollution but also imposes a huge economic loss as agro-waste is usually rich in bioactive agents which are beneficial in New Product Development. There are several researches conducted to recycle or upcycle such agro-waste and several attempts

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were made to develop a new product. One of the successful attempts is to utilise date palm seeds, which is an agro-waste with many beneficial properties to prepare a functional beverage.

At the point where health, environment and economical status are of the major concerns, utilising the agro-waste of date palm fruits for developing a healthy caffeine free beverage is worth the commercial market for betterment of all. In another perspective, this beverage made out of date palm seeds would be a great alternative for coffee. Coffee is widely used across the world to support daily activities. Consumption of coffee may definitely have benefits such as wakefulness, staying active etc. But, it is also reported that intake of coffee resulted in higher blood pressure and also caffeine content in coffee causes insomnia, nervousness, restlessness, nausea and vomiting (S. Satel, 2006). These disadvantages of coffee are also recognised by general public. However, many of them are not able to control their addiction/love towards coffee, whereas there are people who are looking for better options as decaffeinated coffee. Here comes the ability of date palm seeds which can produce caffeine free coffee-like powder with desired properties like 0% caffeine and properties of functional foods which significantly promotes human health. Hence, this beverage made out of date palm seeds powder would be a better option for many consumers.

2. History of Date Palm Fruits

Phoenix dactylifera, commonly known as date or date palm, is a flowering plant species of *Arecaceae* family. They are cultivated to obtain the nutritious fruits. The origin of date palm is uncertain as it was cultivated from ages! Probably, the fossil records tell us that these trees have existed for minimum of 50 million years and Egypt or Persian gulf or western India are the probable options for origination. Dates have been the staple food in Middle Eastern.

Dates also have significant cultural and religious importance. The date palm fruits are crucial part of Ramadan festival; they follow a strict fast for 30

days and will end it with consuming date palm fruits. The nutritional significance and health benefits of date palm fruits are recognized by the holy book Quran.

Similarly, the date palm fruit is recognized spiritually in Judaism and Christianity, and it is connected with religious ceremonies like Palm Sunday and Pesach (Musselman, 2007). Just like in the Quran, the importance of date palm fruits is recognized in the holy book Bible too, and is praised for its manifold virtues and are considered as one of the holy foods.



Figure 1: Date Palm Tree and Fruits

The fruit is a single, oblong berry characterized by a terminal stigma, a fleshy natural covering and a membranous pit between the seed and the fruit (Zaid and de Wet, 2002). Reportedly, the average percentage of the fleshy fruit (including the pericarp and mesocarp) is 85-90% and the pit

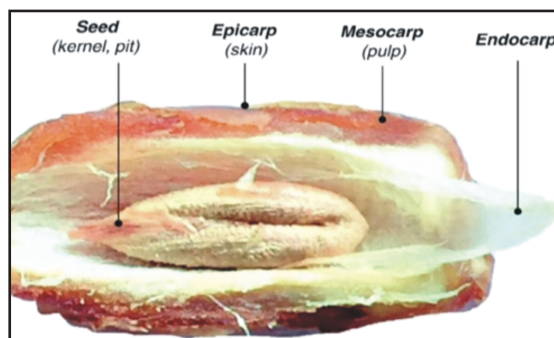


Figure 2: The dissection of the date palm fruit at the Tamr stage (Ghnmiet al., 2017)

or seed is approximately 10% of the total weight of a whole date in complete ripening stage (Sami Ghnim 2015).

2. Different ripening stages of fruit

The ripening stages of a date fruit is usually classified into five stages Hababouk, Kimri, Khalal, Rutab and Tamr (Ghnmiet *et al.*, 2017), named by Arabic words which are internationally employed by numerous authors, e.g. (Ahmed *et al.*, 1995b); (Al-Shahib and Marshall 2003); (Kader and Hosain 2009); (Baliga *et al.*, 2011), as well as Israeli and American date growers.

The fruit improves tenderness, succulence and increased sweetness and decreases bitterness in the last three stages making the fruit edible. The Hababouk stage is the first stage of ripening of the fruit; the fruit is in green colour and has slow growth, taking between 4-5 weeks to finish the process of growth. The second stage of ripening is the Kimri stage, the colour of the date changes from green to light yellow; it takes between 9-14 weeks to complete the growth process and it is not suitable for eating. The moisture content in this stage is 85%. The third stage is the Khalal stage, called the coloured stage. In this stage the date changes from a green colour to yellow or red, which takes around 3-5 weeks to complete. At this stage dates can be consumed as fresh fruit, or they can be used for butter, jam or date-in-syrup. The moisture content in this stage ranges between 45 to 65%. The fourth stage is the Rutab stage, called as soft ripe stage: in this stage the colour of the date changes to light brown and it is soft in texture. It takes between 2-4 weeks to complete the process of ripening, when it is ready for consumption. The moisture content in this stage ranges between 30 to 45 %. The fifth stage is the Tamr stage, the fully ripe stage or last stage in the ripening: in this stage the colour of the fruit turns to dark brown or black. It is soft in texture and has

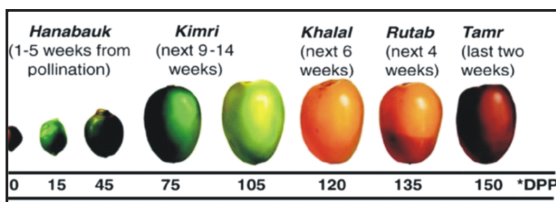


Figure 3: The stages of date fruit ripening according to days post-pollination (DPP) (Ghnmiet *et al.*, 2017).

lost most of the date water and it takes from 2-4 weeks to complete the process of the ripening. It is now good for consumption and storage. The moisture content is <30% in this stage.

All over the world, dates are considered to be highly valued fruit crops. Palm dates are reported to be considered as the nutritional component of the diet and also the staple food source in most Middle Eastern and North African regions. Currently, Egypt followed by KSA, Iran, Iraq stand as the largest producers and exporters of fresh dates. There are more than 300 types of dates produced with variety in texture and flavour.

Dates are usually consumed as fresh fruits and dried dates as well as in form of various products which include date syrup, marmalade, chocolate, sweets, date powder, alcohol and bread. Few countries use date fruits as sweetening agents replacing general sugars like fructose, glucose, sucrose, and maltose. Other parts of palm dates are considered as agricultural product.

3. Date Palm Seeds

Date seeds are also agricultural waste which is mainly used as animal fodder. Date seeds are produced majorly by date fruit processing industries. This is considered as agro-waste and it is generally discarded in the environment which imposes a huge economical loss. However, industries took initiative to reuse date seeds produced from date processing industries. Date seeds are used in the preparation of manure mixture which reportedly revealed that the date seeds are rich source for carbohydrates, proteins, oil, dietary fibre, minerals, phenolic compounds, anti-oxidants and many bioactive compounds (Al-Farsiet *et al.*, 2008).

Date seeds have been chemically estimated and found that the considerable quantity of protein (5.1%), crude oil (9.0%) and dietary fibers (73%) is present in the seeds (Al-Farsi and Lee, 2008a). It is reported that date seeds have lower soluble fibers than the major insoluble fraction. Minerals present in date seeds include potassium, magnesium, calcium, phosphorus, sodium, and

iron. Potassium is present in large quantity and its concentration is 3790 mg/kg (Habib and Ibrahim, 2009). Phenolic compounds and natural antioxidants have high amounts in date seeds (Al-Farsi and Lee, 2008b; Besbeset *al.*,2004) found the highest amounts of total sterols and β -sitosterol for several date seed cultivars.

Date seeds contain numerous bioactive compounds with therapeutic effects against various ailments (Geetha and Geetha,2014). Phytochemicals present in date seeds include flavonoids, phenolic acids, sterols, and tocopherols. Major flavonoid is hesperidin (17.27 mg/100g). While phenolic acids include protocatechuic, hydroxybenzoic, coumaric, ferulic and caffeic acids (Al-Farsi and Lee, 2008b).

4. Health Benefits of Date Palm Seeds

The presence of dietary content, phenolic compounds and antioxidants in the date palm seeds made this agro-waste product to be used as therapeutic components. Reportedly, the dietary fibre content has significant therapeutic implications for diabetes, hyperlipidemia and obesity. In most of the times, it was effective in protecting against prostate cancers, coronary heart disease, hypertension, high cholesterol, colorectal and intestinal disorders (Anderson *et al.*, 2009). The contents of antioxidants and phenolic compounds can effectively protect against major chronic diseases; such as different types of cancer, cardiovascular disease, coronary

heart disease, atherosclerosis and neurological problems, as well as aiding in treating renal stones, bronchial asthma, coughing, hyperactivity and poor memory, helping to reduce blood pressure, relaxing the intestinal and uterine musculature, growing body protein by reducing fat, normalizing blood sugar, and comforting the pancreas (Al-Farsi *et al.*, 2007). Potassium present in the date seeds play an important role as an electrolyte in the body which is closely related to sodium metabolism. It also helps to regulate the heartbeat. Phytochemicals present in date seeds has health benefits like lowering cancer, preventing atherosclerosis, and inhibiting loss of bone. (Al-Farsi and Lee, 2008b; Ambigaipalan P, Shahidi F,2015)

There is no doubt that we believe date palm fruits as one of the super foods, but we also need to recognize the equal potential of date palm seeds which are often considered as agro-waste and being thrown away without further utilization. After many studies and researches, few value added products are developed from date palm seeds. The motive of this review paper is to discuss and review the products made from date palm seeds, highlighting one of the products that is Caffeine Free Functional Beverage. Below are the few varieties of the date seed powder prepared by various professionals across the world.

5. Date Seeds Powder

From the study conducted by Eman Hassan Ahmed Algarni for an article 'Utilization from

Table 1: Chemical Composition of Date Palm Seeds

S.No	Name of the component	Quantity	References
1	Protein	5.1%	Al-Farsi and Lee, 2008a
2	Dietary Fibre	73%	
3	Crude oil	9.0%	
4	Mineral – Potassium	3790 mg/kg	Habib and Ibrahim, 2009
5	Flavonoid - Hesperidin	17.27 mg/100g	Al-Farsi and Lee, 2008b

date seeds as a by-product low-cost to prepare beverage cappuccino and the latte less caffeine', Matured Date palm fruits of sukkari variety grown in KSA (Kingdom of Saudi Arabia) have been used. Nescafe, milk and butter fat cream are the other ingredients which were used along with the final date seed powder for the preparation of less caffeine beverage. This study was conducted at Kingdom of Saudi Arabia (Eman Hassan Ahmed Algarni (2020).

Preparation Method

The fresh fruits were cleaned and the seeds were separated from the flesh of fruit. The obtained seeds were soaked in water for 72 hours which helps the seeds to gain the feeding value and also to wash of the extra fruit content attached to the seed. Seeds were air-dried for one whole day, and then dried using an oven at 50°C for 1 hour.

These dried seeds were grinded using a hammer mill into coarse powder, then again were grounded into fine powder using a commercial home milling machine. The obtained powder was kept in an airtight container to avoid moisture gain from the atmosphere (Barrevel, 1993).

Nutrient and Mineral Content

Nutritional content such as chemical composition and dietary fibre fractions are

determined using the below mentioned methods for various components. Methods prescribed by AOAC 2012 were used to determine the chemical composition of Protein content, total lipids, total carbohydrates and minerals like sodium (Na), Potassium (K), Manganese (Mn), Zinc (Zn), Iron (Fe), Copper (Cu) and Calcium (Ca). The total dietary fibre, soluble & insoluble dietary fibres were determined (Prosky, 1995).

The results showed that the date seeds powder contained the highest amounts in total carbohydrates i.e., 52.87% and crude fiber which was 27.15%. Whereas, the total protein was 7.73%, fat content was 7.90%, and ash 4.35%. Whereas, the mineral content in the date seed powder was observed to be high in potassium which was 133.62mg/100g, followed sodium with 114.2 mg/100g and calcium with 25.02 mg/100g. According these results, it was inferred that the date seeds are indeed rich source of dietary fibres and some minerals which makes the grounded powder a caffeine-free functional beverage (Eman Hassan Ahmed Algarni, 2020).

Phytochemical and Technological properties

Total phenol content of the extracts was determined by using Folin–Ciocalteu reagent (Xu and Chang, 2007). Specific methods were

Table 2: Products prepared using Date Palm Seeds

Source	Products and Application	References
Powder (defatted)	Bread—increases dietary fiber content	(Shokrollahi and Taghizadeh, 2016)(Bouaziz <i>et al.</i> , 2010)
Powder	Pit bread—contains high amounts of phenolics and increased antioxidant activities	(Platat <i>et al.</i> , 2015)
	Used as coffee substitute	(Rahman <i>et al.</i> , 2007)
Extract	Mayonnaise—ensures high oxidative stability and sensory acceptability	(Amany <i>et al.</i> , 2012)
	Oxidative stability of ground beef—increases total polyphenol content and antioxidant activity and lowers TBARS value	(Meer <i>et al.</i> , 2017)
Oil	Used in cooking, pharmaceutical, and cosmetic applications	(Mrabet <i>et al.</i> , 2020)

used to determine the total flavonoid content (Eghdami and Sadeghi, 2010). The antioxidant activity was determined using 2, 2-Diphenyl-1-picrylhydrazyl (DPPH) antioxidant assay (Liu *et al.*,2008). Modified methods were used to determine the reducing antioxidant power of the sample using 2,2'-Azinobis-(3-ethylbenzothiazoline-6 sulfonic acid) (ABTS) (Chen *et al.*, 2014). The results of these experiments are tabulated in Table 4.

Sensory Evaluation

Cappuccino and latte formulae, was prepared by using the date seeds powder at different concentrations such as 10%, 20%, 30%, 40%, 50% and 60%. And these were compared with Nescafé as a control. Sensory Evaluation was performed for Cappuccino and latte formula,

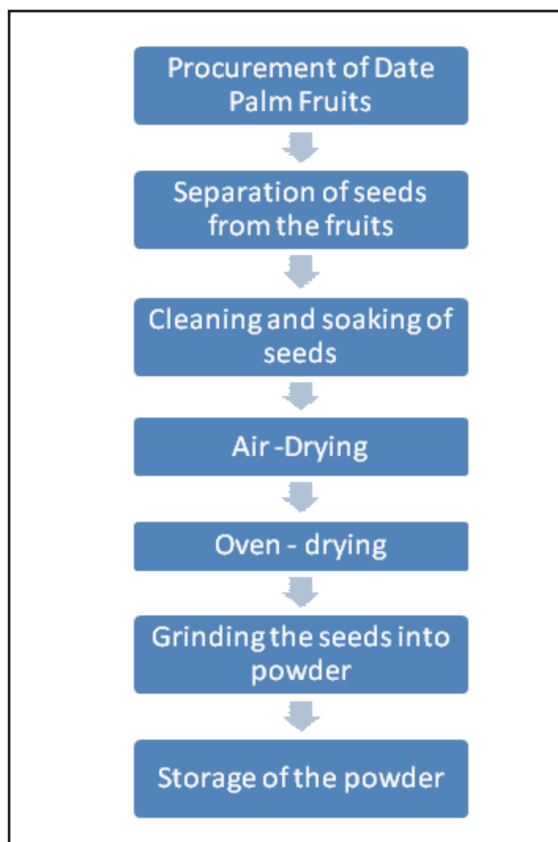


Figure 5: Flowchart for preparation of Roasted Date Seeds Powder (Sami Ghnimi, 2015)

which was presented in different number of cups to ten panelists of staff members at the Food Science and Nutrition Department, College Science, Taif University, Saudi Arabia, who were asked to rate each sensory attribute. Date cappuccino and latte were evaluated for aroma,

Table 2: Nutrient content of Date Seed Powder (Algarni, E.H.A., 2020)

Nutrients	Percentage in Date Seed Powder
Protein	7.73%
Fat	7.90%
Crude Fibre	27.15%
Ash	4.35%
Total Carbohydrates	52.87%
Total dietary fibre	67.56
Insoluble dietary fibre	46.38
Soluble dietary fibre	21.18

Table 3 Mineral content of Date Seed Powder (Algarni, E.H.A., 2020)

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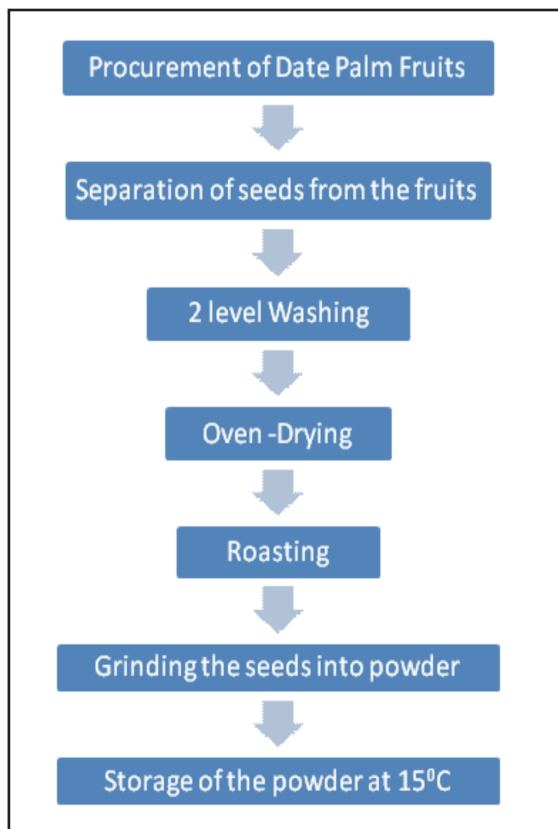


Figure 5: Flowchart for preparation of Roasted Date Seeds Powder (Sami Ghnimi, 2015)

color, taste, bitterness, mouthfeel, and overall acceptability according to (Hoda and Jood,2005).

The results showed that there were no considerable differences in the flavour, colour and overall acceptability until the concentration of date seed powder reaches 50%. At this level, the panelists noticed significant difference with the controlled sample. The members who conducted the study inferred that may be better production methods or by some change in flavour would have given the best taste. But nevertheless, it can still be introduced as coffee from date palm seeds which would be a healthy alternative for the caffeine sensitive consumers.

6. Roasted Date Seeds Powder

From the study conducted by Sami Ghnimi for a research article 'Quality Evaluation of Coffee-Like Beverage from Date Seeds (*Phoenix dactylifera*, L.)', 15 kilograms of Date palm fruits samples of Khalas, Khunaizy and Fard varieties were collected from a company in UAE. This is used to prepare date seed powder for the preparation of caffeine free beverage. This study was conducted at UAE.

Preparation Method

The fruits were cleaned and the seeds were separated from the flesh of fruit. The obtained

Table 5: Concentrations of few selected components in three commercial roasted date seed powders compared with ranges in Arabian coffee (mg/Kg) (Sami Ghnimi, 2015)

Properties		Date seeds powder
Phytochemical/ Antioxidant (mg./g dry weight)	Total phenol	13.20
	Total Flavonoids	5.15
	DPPH	57.25
	FRAP	0.04
	ABTS	1.92
Technological properties	Water absorption capacity WAC ml/g	0.48
	Fat absorption capacity FAC ml/g	0.87
	Emulsification capacity E.C. mg oil/g	79.38
	Emulsification activity E. A. ml/100ml emulsion	55.67
	Emulsification Solubility E.S %	69.17

seeds were washed thoroughly with normal tap water, then again with distilled water which helps seeds to be dirt free. Seeds were dried in an oven at 80°C for 8 hours. These dried seeds were roasted at 220°C for 6 hours. The roasted date seeds were grinded and preserved at 15°C for further analysis.

This study focused on the quality of the beverage made with date seeds (prior to roasting the seeds) and hence the date seeds weight, length and diameter of the date seeds were measured and also volume, density, hardness of the seeds and HV (Vickers hardness) were determined.

The roasted date seeds were observed for the changes induced by roasting in colour and pH. The colour of the roasted date seed powder was also evaluated for every 30 minutes.

The roasted date seed powders were sent to different analysis to determine the composition of few nutrients and elements.

Different methods were followed and following results have been observed.(Table 5)

Sensory Evaluation

All the four kinds of powders were made into brew with 45g of each variety taken into 100 ml of water and boiled for 2 minutes. A 15 point hedonic scale was used where 0th is the least and 15th is the highest. Sourness, bitterness, sweetness, flavor, aroma, cloudiness, color, mouth feel and overall quality were evaluated. The results are tabulated in the table 6. There was significant difference in the mentioned attributes in comparison with Arabian coffee.

It was inferred that Roasted date seed extracts may be improved by altered production technique(s) and /or by addition of spices to induce better taste and higher nutritional and health benefits.

7. Defatted Roasted Date Seeds Powder

From the study conducted by Mohammad Fikry for an article 'Effect of the Roasting Conditions on the Physicochemical, Quality and Sensory Attributes of Coffee-Like Powder and Brew from Defatted Palm Date', Date palm fruits of sukkari variety were purchased from local markets of

Table 5: Concentrations of few selected components in three commercial roasted date seed powders compared with ranges in Arabian coffee (mg/Kg) (Sami Ghnimi, 2015)

Components	KSA Light variety date seeds powder	KSA Dark variety date seeds powder	UAE variety date seeds powder	Arabian Coffee
Sodium (mg/Kg)	57	54	18.7	6.6
Potassium (mg/Kg)	2147	2167	2396	11400
Calcium (mg/Kg)	356	355	306	490
Copper (mg/Kg)	6.7	6.4	5.5	0.4
Iron (mg/Kg)	25.4	79.4	18.1	12-617
Total phenolic content (TPC) (g of Tannic Acidequiv./100g of sample)	0.65	0.82	0.50	2.53
Ferric reducing antioxidant power (FRAP) (g of Tannic Acidequiv./100g of sample)	2.91	3.03	1.99	8.87
(DPPH) radical scavenging activity. (% reduction in absorbance)	70.4	71.1	64.9	73.0

Table 6: Sensory score of the three commercials roasted - date seed coffee alternatives compared to a sample of Arabic coffee (Ghnimi S., 2016)

Attribute	KSA Light	KSA Dark	UAE	Arabic Coffee
Color	4.0	4.7	5.5	7.7
Cloudiness	7.7	8.2	9.4	10.7
Roasted aroma	6.5	5.6	6.3	6.8
Sourness	1.1	1.4	0.8	2.2
Bitterness	6.6	6.6	5.6	8.9
Coffee flavor	7.7	7.1	7.1	9.9
Overall quality	7.8	9.3	8.7	10.9

Saudi Arabia where the study was conducted too. The fresh fruits were cleaned and the seeds were separated manually from the flesh of fruit. The obtained seeds were soaked in hot water at 100°C for 1 hour to wash of the adhering residual. Seeds were dried at 50°C for 24 hours to ensure the water from surface is expelled out. These dried seeds were roasted using a natural convection oven at three different temperatures of 160°C, 180°C and 200°C. All the roasted seeds were allowed to cool down and then grinded into powder using a hammer mill. The powder was undergone through defatting process prescribed by Mohammad Fikry. Soxhlet apparatus was used to extract the oil from the powder. The obtained powder was packaged in polyethylene bags and stored under refrigerated conditions. During the above process, few precautions were taken such as pre-heating the oven for 1 hour to ensure that the steady-state was reached. Samples were duly monitored while roasting in the oven.

Sensory Evaluation

There were total of 9 samples which have different temperatures and times of roasting.

Sensory evaluation was conducted with 30 Arabian assessors. A nine-point hedonic scale was used for evaluation, where 1 is least liked, 5 is neither liked nor disliked and 9 is extremely liked. Colour, aroma, taste and overall preference are assessed.

The highest score for colour and overall appearance was found to be at 200°C for 20

minutes. It is also observed that the score increased with temperature and time but however decreased for the last combination of temperature and time. The highest score for taste and aroma was found to be at 200°C for 10 minutes. It is also observed that the score increased with temperature and time but however decreased for the last combination of temperature and time.

The highest score for colour and overall appearance was found to be at 200°C for 20 minutes. It is also observed that the score increased with temperature and time but however decreased for the last combination of temperature and time.

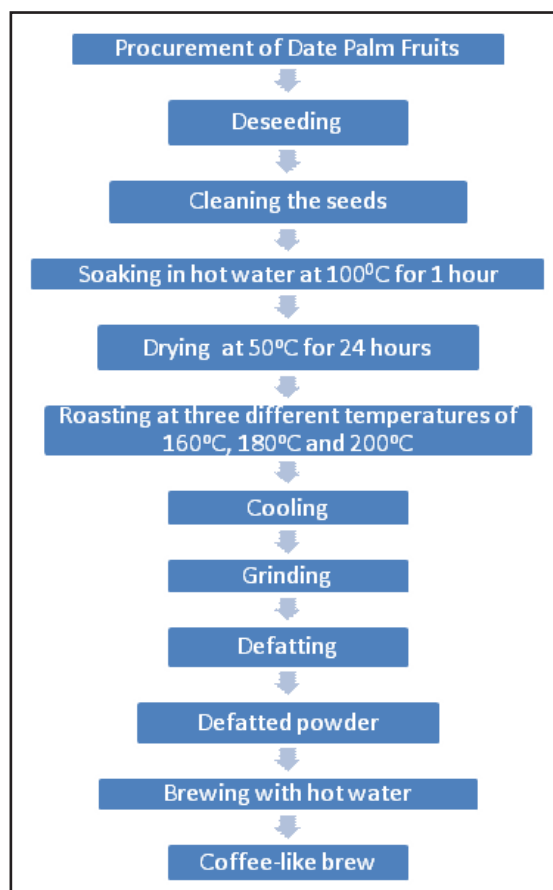


Figure 6: Flowchart for preparation of Defatted Roasted Date Seeds Powder (Mohd. Fikry, 2019).

8. Date Palm Seeds – A source of caffeine-free beverage

After several researches and trials as discussed, date palm seeds are now being considered as a caffeine-free beverage in and around Arabian country.

It is established that the date palm seeds can be processed into a powder which can be brewed like coffee but comes with a great and desirable characteristic for a wide range of consumers i.e., caffeine free.

Turkish caffeine free coffee was prepared with mixing flavor to give healthier coffee low in price, and it was made from date seed to make it tasty. It was also utilized in preparing 'Cappuccino Choco Float' where it is mixed with chocolate (Abdillah and Andriani,2012).

Reportedly, Roasted Date Palm Seeds powder is being utilized as Arabian coffee known as gahwa, it is widely found in Arabian countries such as KSA and UAE. This coffee/ functional drink is accepted as an alternative brew to coffee since it significantly promotes human health and is effective against high blood pressure, hypertension, panic attacks, anxiety, depression and related symptoms which are usually caused due to high intake of caffeine (M. A. Alsaifet *et al.*, 2007).

Apart from being effective against negative health impacts, it also helps in digestion, fertility and better skin. Along with these health benefits, the brew prepared from Roasted Date palm seeds powder gives the satisfaction to the consumers who love coffee, but maybe sensitive or concerned with the caffeine content because the drink made from date palm seeds powder almost tastes like coffee due to similarity in aromatic compounds and it is completely caffeine free with functional food properties making their lives healthy and happy.

Several other attempts were made to utilise date seeds, which include using date seed powder as an ingredient in food products like muffins, cakes, other bakery products and confectionaries.

9. Functional Food

A functional food can be defined as natural or processed food with added constituents or greater than nutrients which significantly promote human health. It was explained that food is also known as functional if it appropriately affects one or more target function in the body. The functional foods are also called as medical, designer, prescriptive, therapeutic and nutraceutical foods. The concept of functional food was first coined by Japanese scientists who considered the interaction between nutrition,

Table 7: Sensory attributes of the brew in relation to roasting temperature and time (Mohammad Fikry, 2019).

Roasting Conditions		Colour	Aroma	Taste	Overall Preference
Temperature (°C)	Time (min)				
160°C	10	2.73	2.60	1.93	2.73
	20	4.33	3.53	2.40	4.07
	30	5.27	4.47	4.53	4.80
180°C	10	5.33	5.67	5.47	5.07
	20	5.93	6.00	6.67	5.67
	30	6.13	6.53	7.00	6.13
200°C	10	6.07	6.60	7.33	6.13
	20	6.67	6.20	5.53	6.67
	30	5.13	4.27	4.40	4.73

sensory approval, fortification and variation of physiological system and attained legal status in 1991, described as Food for Specified Health Use (FOSHU).

The increasing attention towards the functional foods with special function and health promoting components are the main cause of new functional beverages. This is where date seeds have an own place in the sector of functional foods. Mostly, the above mentioned caffeine free beverage made with Date Palm Seeds powder is also a functional beverage as it not only provides the needed nutrients but also provides added constituents like phenolic compounds, antioxidants and bioactive compounds which plays a vital role in promoting many health benefits.

10. Functional Food Applications of Date Seeds/pits

Date pits as a source of dietary fibres

Date pits are a rich source of dietary fibre, consumption of these dietary fibres are known to control blood pressure, blood glucose, blood insulin and improve gastrointestinal health (Clemens *et al.*, 2012). The dietary fibre content present in the date pits is suitable in preparing fibre based foods like bread, biscuits, cakes and dietary supplements (Almana and Mahmud, 1994; Larrauri *et al.*, 1995).

It has been reported by Ambigaipalan, & Shahidi (2015) that the incorporation of date seed flour into muffins resulted in increased total dietary fibre content, radical scavenging activity.

There are few more applications of date seeds as functional foods. Platat *et al.* (2015) incorporated date seeds powder in bread at different concentrations and studied its phenolic, antioxidant activities and functional properties. The results came out to be high in the reformulated breads than in a regular whole wheat bread; therefore, date seed powder made these breads functional food. Another study showed that the effect of defatted date seed powder on bread quality enhanced the dietary

fibre content (Bouaziz *et al.*, 2010; Shokrollahi and Taghizadeh, 2016).

Date pits as a source of Coffee

Another study suggested the date palm seed powder as being used as a substitution for the regular coffee (Rahman MS, Kasapis S, Al-Kharusi NSZ, *et al.*, 2007).

Date pits as sweeteners

Tunisian date palm by-products such as date syrups and powder can also be used as sweeteners in many products (Jridi Met *et al.*, 2015).

Date pits as a source of edible oil

Edible oil can be extracted from the date pits, but it has relatively lower oil content compared with other oil yielding crops (Al Shahib and Marshall, 2003; Besbes *et al.*, 2004). The property which differentiates the date pit oil from other vegetable oils is that it has unique fatty acids and tocopherols composition.

Recently, date pit oil was used in mayonnaise production (Basunny and Al-Marzooq, 2011). It was observed that the sensory characteristics of mayonnaise containing date pit oil were superior in comparison with regular vegetable oil. The potential functional and economic utility of date pits oil could be considered as a new source of oil.

11. Future Potential of Date Palm Seeds

Date palm seeds have a great potential to be used in various forms in the near future with increased efforts and technology. The sectors of pharmaceuticals, nutraceuticals, cosmetics and agriculture have a great probability of using date palm pits in their industries.

12. Conclusion

The Date palm fruits are rich in dietary fibre, proteins, carbohydrates, vitamins and minerals. They consist of all the required nutrients for a healthy life style. Along with the fruit, the date pit is also significantly nutritious and fortunately after deliberate researches, now they are recognized as healthy too. The date palm seed or pits are rich in dietary fibre, proteins,

carbohydrates, potassium, phenolic compounds and flavonoids. These nutrients come along with various health benefits which are an important concern for the people of present generation. Date Palm Seeds are studied and processed into different products. Three processing methods of converting date palm seed into powder to brew a functional beverage were reviewed i.e. Date palm seeds powder, Roasted Date Pam Seeds Powder, Defatted Roasted Date Palm Seeds Powder. All the three methods revealed that the nutritional composition of date palm seed powder plays an important role as functional foods. The consumption of this caffeine free functional beverage promotes human health and this ingredient has potential future aspects.

13. References

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