Exploration of making date seed’s flour and its nutritional contents analysis

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Abstract. The date palm (Phoenix dactylifera L) is one of the oldest fruit plants that identical with people’s lives in the Middle East including The Kingdom of Saudi Arabia since ancient times. The date palm is known and consumed by most of people in the form of fruit flesh, while its seed is discarded tough it is rich in nutrient. Therefore, need to be explored the potential of date seed through product innovation of foodstuffs with a high nutritional value. The aims of this study were to 1) know how to make flour from date seed, and 2) determine nutritional content of date seed’s flour. This study was experiment and conducted in July, 2015 at the laboratory of food technology, Family Welfare Education department. Chemical analysis was used to determine nutrients content. The results showed 1) the flour of date seed produced from the process of washing, soaking, flushing, boiling, draining, drying, grinding, and sieving; 2) the flour of date seed’s flour have a macro nutrients value. This study explains that date seed is regarded as rubbish, in fact, it has a high value that can be an alternative substitution of wheat flour.

1. Introduction
Date (the date palm/dates) has been known widely by society that related to their’s life in the Middle East and The Kingdom of Saudi Arabia. In almost all areas of this region, it is consider as part of the most people diet because of its benefits are good for health. A people there used to eat date as main dish. However, in Indonesia the date fruit is mostly found in the market in the Ramadan until Eid Hajj’s month that its consumption tend to increase. Date is generally consumed, either eaten immediately or in various types of food and beverage, such as cake, pancake, pie, sus, pudding, sauce, ice cream, date’s stew, syrup, jam, tea, and juice [1] and cookies [2]. On the other hand, the date palm is useful to take care of eyes, bones and teeth’s health, lung cancer, cancer and colon prevent. In the terms of nutritional value, it has 23 calories, 9-13 of soluble fiber, 2.5-4.3% crude fiber, 1.4-1.7 grams/100 grams protein of date flesh (0.3-0.5% 100-800mg/100g wet weight, fatty acids and potassium amounted)[3]. People generally know that the date palm is consumed fruit flesh only. Such views are not always true. Because, it can be used as a whole, including seed that is considered as a rubbish. Whereas its seed contains of 71.9 to 73.4 % of carbohydrate, 5 to 6.3 % protein, 9.9 to 13.5 % fat, 6.4 to 11, 5 % fiber, and 1 to 1.8 % of ash. Date seed can be useful materials for flour [4]. It is assumed with semi-processed form of the equivalent protein value of wheat flour, which means it can be used date seed into various preparations such as cakes, breads, pastries and others. Therefore, the date palm can be used for foods which have a history and religion value.

The date palm had a history value in the world. This plant thought to have come from the plains of Mesopotamia, Palestine, or about northern Africa (Morocco) around 4000 BC. It spread into areas of Egypt, Africa, Central Asia, and the surrounding areas since 3000 BC. In terms of religious aspect, the date palm is quite special to get a place. The palm leaves as a symbol of...
longevity; the fruit is a symbol of the presence of the god Amun ra’ and the fertility goddess Hathor. In the ancient Egyptian nation, the date fruit is used as a dish in the morgue, and is found as one element in the process of purification corpse preservatives.

The date palm is from family of Arecaceae which have seeds with one institution (monocots). Date seed do not have a smell or odorless and has a slightly bitter taste bland. In general, it has a light and dark brown. Today, a various studies regarding date seed have been published in order to determine the functional properties of date seed is used for food and non-food items such as thermal properties [5], treatment and diet [6][7], the composition of macro and micronutrients [8], the composition of phenolic acids [9], as an ingredient of bread [3], and protein solubility [10]. Date seed are highly recommended for use in foods and dietary supplements. Because, it is a very good source of dietary fiber [9]. Total mineral content found in single seed is comparable to the mineral content of barley. The minerals contained in date seed include sodium, potassium, calcium, iron, copper, magnesium, manganese, zinc, phosphorus, lead, cadmium. This suggests that a single seeds is a good source of minerals, and also can be used to replace barley in food products [11]. The amount of dietary fiber found in date seed about 58 % of which 53 % soluble dietary fiber as hemicellulose, cellulose and lignin [7][9]. In comparison, the higher dietary fiber was detected in other studies conducted in three different varieties of date seed, the number of fibers between 65 to 69 percentage. This shows the high content of lignin and resistant starch [10].

On the other hand, protein is also found in date seed with a sizeable amount. Albumin, globulin, prolamin and glutelin are soluble protein which found in seed of the current date, the number of 5-6 percentage of the total protein level [10]. Total phenolic content which is found in date seed is 48.64 mg / 100 g. Phenolic acids contained in date seed that the gallic acid, acid protocatechuic acid p-hydroxybenzoic acid vanilla, caffeic acid, p-coumaric acid, ferulic acid, acid m-coumaric and o-coumaric acid [12]. Based on Boundries [1], indicated that the highest antioxidant content is in that seed, included penolic, Thus it can be further developed into new product or improve existing product. Various studies indicate that date seed can be used as a good source of dietary fiber, phenolic components and natural antioxidants. Date seed actually have a more complex function as a food source that can improve the health of the body. It is necessary to further research to explore the way of making flour made from date seed with emphasis on the different drying process.

2. Materials and Methods
This research was conducted at the laboratory of food technology, Family and Welfare Education Departement, Faculty of Engineering, in July, 2015. Equipment used in this study is the basin, siever, pan, hammer, and grinder. The materials are used for flour production included the date palm seed of Tunisia’s type which collected from producers who make cookies by using the date fruit in ied Mubarak. It chosen because this is one of the preferred types of date that many people of Indonesia, as well as the largest importer of dates for this type [1]; Natrium bisulfite. This material is used to maintain color and to prevent browning reaction during the heating process, and tap water for cleaning the date seed. These presented in the table 1 as follow.

| Materials          | Total   |
|--------------------|---------|
| Date seed          | 2500 gram |
| Natrium bisulfite  | 500 ppm  |
| Tap water          | 2 l     |

The methods were used are 8 steps, namely 1) washing, This step aims to clear up residual and dirt in seed by means washed the seed with tap water; 2) soaking. When seed has been cleaned, then soaking it into natrium bisulfite (NaHSO₃) for 24 hours This aims to maintain the color and prevent the profusion of browning reaction during warming process; 3) flushing, This step aims to clear up the seed after soaking process; 4) boiling, The next step is boiled seed in the water with 80-90°C of temperature during 10 minutes, it is mean to soften the texture of date seed; 5)
draining. After that drained it to make drain faster before drying process; 6) drying. The drying process in this research are using by two treatments, namely drying under the sun for two days, and drying by oven for 24 hours at 50-60°C. This process aims to dry date seed to allow in the grinding process; 7) grinding. The grinding have two steps. The first step is date seed is hammered. This is done because the outer skin of the date seeds are very hard, and to get a rough flour that seed have to destroy with a hammer. The next step is grinding by using machine. This aims to get the ideal texture of date seed’s flour before performed by siever; 8) the last method is sieving. The aim is to get smooth of flour texture is sieving by using stainless siever. The explanation of methods of making date seed’s flour present on picture 1 as follow:

3. Results and Discussion

3.1. The flour of date seed

Based on the results of the experiment can be explained that the flour of date seed which made from Tunisia’s type is conducted through eleven stages, namely washing, soaking, flushing,
boiling, draining, drying, grinding, and sieving. It supports the research that conducted by [4], the seed’s flour of date seed obtained by washing, soaking, boiling, drying, grinding, and sieving.

A difference in the two studies are located at boiling treatment by soaking. In this research, date seed is boiling at 80-90 degrees Celsius for 5-10 minutes which aims to soften date seed; While the research [2] proved that boiling process is not carried out with a high temperature and a long time, but by using blanching technique. It uses blanching techniques and the addition of natrium bisulfite by giving effect to the bulk density and whiteness in flour [13]. Referring to the research of Kusumawati that the recommended temperature to produce color and density of grain flour is not more than 70 degrees Celsius. While in this study date seed boiling process is used too high temperatures (80-90 degrees Celsius). Thus, the boiling temperature of date seed in this study is not recommended to be used as a reference because it will affect the color and density of date seed grain flour. Although the temperature of boiling had no effect on bonding compounds contained in date seed’s flour.

The most important stages in the process of making flour from the seeds of these date palm are soaking by using natrium bisulfite. The aims of it to defend the colors of the materials and prevent non-enzymatic browning reactions as well as enzymatic, as well as to inhibit microbial growth [14]. The other importance stages is the drying process in two ways, namely solar thermal and heat oven. The aims of this two-way warming is intend heating with solar heat have better results in terms of the quality of the material, it is supported by research [15] that heating with sun better than a hot oven, although the weakness it takes a longer time.

3.2 Nutrients content of date seed’s flour

Results of the chemical test analysis on date seed’s flour with different drying process is presented in Table 2 below. In this study, date seed’s flour dried by the sun heating has better nutritional value compared with the nutrients that are heated in the oven. The flour of date seed with sun dried process contains 33.84% of carbohydrates; 26.52% of Protein; 31.54% of Fat; Minerals (102.42 mg /100gr of Ca, 81.05 mg/100gr of P, 16.54 mg/100gr of Fe), also vitamins (3.08 mg/100gr of B, 23.55 mg/100gr of C). Whereas the nutritional value of date seed’s flour through a drying oven was 5.03% of protein; 12.37% of fat; Minerals (64 mg/100gr of CA, 62 mg/100gr of P, 16.54 mg/100g of Fe), and vitamins (5% of A, no C, 2% K). The amount of 26.54% protein contained in the date seed’s flour with sun heat as much as protein in date seed’s flour with oven heating only one-fifth of the protein date seed’s flour with sun heating that is as much as 5.03%. The carbohydrate content of the date seed’s flour with sun heat as much as 33.84%. The results of protein content in this study are better than the results of previous studies which have been carried out by [16] that protein in the flour contribute to improve water absorption of flour as the manufacture of cakes dough by using flour with a high protein material can withstand the gas allowing the developer and the dough can swell up like a balloon. Results of the cake with this dough will have a cavity structure is smooth and uniform, and the texture is soft and elastic [17]. High protein flour (hard wheat) has a total protein content of 12-13%, while the protein content in date seed flour with better solar heating is 26.54%. This proves that date seed’s flour can be an alternative food substitute for wheat flour. Whereas the nutritional value of date seed’s flour through a drying oven was 5.03% of protein; 12.37% of fat; Minerals (64 mg/100gr of CA, 62 mg/100gr of P, 16.54 mg/100g of Fe), and vitamins (5% of A, no C, 2% K).

| Table 2. Nutrients content of date seed’s flour |
|-----------------------------------------------|
| Nutrition component | Sun heat (%) | Oven heat (%) |
| Carbohydrate         | 33.84%       | 25.64%        |
Protein 26.54% 15.03%
Fat 31.54% 17.37%
Mineral Ca 102.42 mg/100gr 64 mg/100gr
Mineral P 81.05 mg/100gr 62 mg/100gr
Mineral Fe 16.54 mg/100gr 16.54 mg/100gr
Vitamin A 7% 5%
Vitamin B 3.08 mg/100gr 2.03 mg/100gr
Vitamin C 23.55 mg/100gr 17.55 mg/100gr
Vitamin K 2.9% 2%
Water content - -
Ash content - -
Fiber - -

4. Conclusions

4.1. The flour product of date seed which made from Tunisia’s type is conducted through eight stages, namely washing, soaking, flushing, boiling, draining, drying, grinding, and sieving.

4.2. Date seed’s flour dried by the sun heat has better nutritional value compared with the nutrients that are heated in the oven. The amount of 26.54% protein contained in date seed’s flour with as much as the protein in date seed’s flour with oven heating only one-fifth of the protein palm seeds flour with sun heat that is as much as 5.03%. The carbohydrate content in date seed’s flour with sun heat as much as 31.54%.

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