



Nutritional potential of date palm fruit (*Phoenix dactylifera*) and its possible use as sweetener

O.O Akinola¹*, D.O Oyinloye¹, O.I Oguntade², I.G Orji¹

¹Nutrition and Dietetics Department, Federal Polytechnic, Ede, Osun State, Nigeria. ²

² Home Science & Hospital Management: Human Nutrition & Dietetics, Olabisi Onabanjo University, Agowoye, Ogun States, Nigeria.

Abstract - Dates are considered to be a staple food. It is a well-known fruit which has been consumed throughout the world for a long time. It is one of mankind's oldest cultivated plants and has been used as food for about 6000 years (Al-Farsi and Lee, 2008). This study was carried out to determine the proximate, minerals, anti-nutrient composition and functional properties, and to evaluate the sensory properties of the pap sweetened with the formulated date flour. The results of proximate composition were as follows: moisture (5.12g), fat (14.48g), ash (7.09g), crude protein (20.87g), crude fiber (2.30g), total carbohydrate (50.04g). the mineral value were: calcium (51mg), magnesium (40mg), potassium (126mg), zinc (2.42mg), copper (0.25mg), iron (1.39mg), manganese (2.00mg) and sodium (70.95mg). The results of anti-nutrient composition were as follow tannin (2.10mg), saponin (47.00mg), phytate (40.00mg) and oxalate (5.00mg). the results of the functional properties were: water absorption capacity (67.33), oil absorption capacity (79.33), Bulk density (10.0) and gelatinization (77oc). The result obtained from the sensory evaluation showed that the taste and flavor of the pap sweetened with the formulated date flour was equally acceptable as that of granulated sugar. There were no significant differences in colour and mouth feel of the two sample but the texture and appearance of pap sweetened with sugar was slightly preferred to that of date flour. The granulated sugar was slightly more acceptable than date flour as a sweetener. Date palm fruit contain an appreciable amount of nutrients such as minerals and fibre if improved upon in terms of texture and appearance can help in controlling the blood sugar level when consumed as a sugar substitute should not exceed 250 words and should concisely state what was done, how it was done, principal results, and their significance and/or contributions. It should be also noted that abstract should not contain any equations, references, or footnotes.

Keywords: *Date palm, sweetener, proximate, sugar, proximate*

1. Introduction

Date palm could be one of the oldest cultivated plants, Date palm is now grown extensively for its edible fruits under warmer climates across all the continents with a history of more than 6000 years. The world production of dates has increased from about 4.6 million tons in 1994 to 7.68 million tons in 2010, with expectations of continuous increase (Al-Farsi and Lee, 2008). Nearly 2000 cultivars of date palm are known in the world, but only some have been evaluated for their performance and fruit quality. The date palm (*Phoenix dactylifera* L.) plays an important environmental, and economic role for many people living in arid and semiarid regions of the world. (Saba et al, 2015). The importance of fruits as a source of nutrients which make many researchers including Nigeria develop interest in it (Anhwange et al., 2004; Hassan and Umar, 2004; Umar et al., 2007).

Dates can be readily available in the groceries year-round. Some varieties of fresh, soft, good-quality fruits, however, only found from September through December. In certain dry regions of Africa, dates gathered while just reaching maturity and allowed to ripen inside the jars. Dates are one of the most popular fruits packed with an impressive list of phytonutrients, vitamins, and minerals that are essential

for normal growth, development, and overall well-being. Date provide a wide range of essential nutrients, and are a very good source of dietary potassium. The sugar content of ripe dates is about 80%. The remainders consist of protein, fibre and trace elements including boron, cobalt, copper, fluorine, magnesium, manganese, selenium, and zinc (Walid Al-Shahib, Richard J, Marshall, 2003 It contains abnormal state of sugar substance, vital vitamins and high supplement thickness. In perspective of the present rate of populace development in creating nations, date palm natural product may be more valuable in some sustenance definitions than for direct utilization in the wake of cooking/simmered. The use of any seed as a source of nutritious food arises from the knowledge of the chemical composition of its flour and other products (Ogungbenle, 2011).

Dates constitute an important part of a balanced diet as they are natural sources of nutrients needed by humans and animals. These nutrients include protein, carbohydrates, minerals and dietary fiber (Sadiq et al., 2013). Also, dates are rich source of antioxidants, mainly Carotenoids and Phenolics (Rock et al., 2009 and Al-Farsi and Lee, 2008). The antioxidant activity of dates differs according to their contents of phenolic compounds, vitamin C, vitamin E, carotenoids and flavonoids (Al-Turki et al., 2010) Phytate level varies in food according to growing conditions, food age, processing and testing methods (Nagel, 2012). The goal of conducting this study is determination of anti-nutrients of palm date fruits (phytate, tannins & oxalate) and antioxidant activity, phenolic compounds, flavonoids, and ca

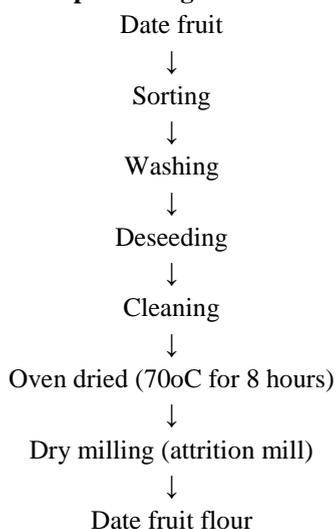
2 Materials and Method

Method of processing date fruit into flour

The dried date fruit was procured from the local market in Ede Town (Timi Market) in Osun state

The date fruit procured was sorted out and washed to remove dirt and unwanted materials. Afterward, the date was deseeded, cleaned and dried in the oven at 70oC for 8 hours, it was then milled into flour with an attrition mill (Christy hunt, England).

Flow chart for the processing of date fruit into flour



(Source African journal of Good Agriculture Nutrition and Development)

2.1 Chemical analysis of anti -nutrient properties

Oxalate was determined by Day and Underwood (1986), one gram of date powder in a conical flask and 75 ml of 15N H₂SO₄ added to it while Phytate content was determined by the procedure described by Haug and Lantzsch, 1983 and Maga, J.A. (1983)) using a spectrophotometer (Irmeco U-2020) at 519nm, also Tanin determination was carried out using AOAC (1984), while Saponin was determined by Brunner (1984).

3 Functional Properties of Date

Selected functional properties namely water absorption capacity (WAC), oil absorption capacity (OAC), bulk density (BD) and gelatinization temperature (GT) were analysed. Water and oil absorption were determined by the method of Lin et al. as modified by Okaka and Potter. 2g of the sample was weighed into 15ml centrifuge tube and 10ml of distilled water or oil was added. The sample was mixed thoroughly and allowed to stand for 30 minutes at room temperature and centrifuged at 2000-5000 rpm for 30 minutes. The volume of free water /oil (the supernatant) was read directly from the graduated centrifuge tube. The amount of water and oil retained by the date flour was calculated from the difference in volume of the initial amount of water or oil added to that decanted after centrifugation.

Bulk density was determined by the method of Okaka and potter (Suresh et al, 2015) 50g of the flour sample weighed into a graduated cylinder and its volume was recorded. The cylinder was tapped constantly on the table (10-15times) until there was no further change in volume. The BD was calculated as the weight of the weight of the date flour samples in grammes (g) divided by the volume of the tapped date flour sample in millimeters (ml). The method of Okezie and Bello (Wijesinghe et al 2016) was adopted for determination of gelatinization temperature. 10% suspension of the date flour sample was prepared in a test tube and the mixture was boiled with continuous stirring. The temperature was recorded 30 seconds after gelatinization was visually noticed. Gelatinization temperature was taken in degree centigrade. Sensory evaluation was carried out on the date flour using a nine-point hedonic scale. Twenty untrained panelists were used. The panelists were asked to indicate their preference for the samples in term of taste, flavor, mouth feel, acceptability, appearance and colour.

4 Results and Discussion

Table 1. The proximate composition of date fruit (mg/100g) dry weight

Parameter	Date Flour
Moisture	5.21 ± 0.74
Fat	14.48 ± 0.53
Ash	7.09 ± 0.20
Crude Protein	20.87 ± 0.67
Crude Fibre	2.30 ± 0.09
Total Carbohydrate	50.04 ± 0.68

The results of the mean of 3 determination SD

Table 2. The mineral composition of date fruit (mg/100g) dry weight

Minerals	Mean of mineral composition
Calcium	51.0 ± 0.015
Magnesium	40.0 ± 0.09
Phosphorous	43.0 ± 0.15
Potassium	126.0 ± 0.011
Zinc	2.42 ± 2.30
Copper	0.25 ± 0.78
Iron	2.42 ± 2.30
Manganese	2.00 ± 2.48

Sodium	70.95 ± 0.013
--------	---------------

The result of mea 3 determination of the ± SD

Table 3. The mean composition of Anti-nutrient content of date flour

Anti-nutrient	Mean composition
Tannin	0.0021 ± 0.0003
Saponin	0.047 ± 0.0058
Phytate	0.040 ± 0.0088
Oxalate	0.005 ± 0.012

The result is the mean of 3 determination ± SD

Table 4. The sensory result of Pap fortified with date and Pap fortified with sugar

Sensory	Pap + Date	Pap + sugar
Taste	7.09 ± 0.40	7.12 ± 0.20
Flavour	6.70 ± 0.21	6.77 ± 0.13
Texture	5.83 ± 0.05	7.12 ± 0.13
Mouth feel	6.13 ± 0.20	6.98 ± 0.10
Acceptability	6.58 ± 0.40	7.18 ± 0.21
Appearance	4.20 ± 2.0	6.97 ± 0.61
Colour	6.63 ± 0.60	7.42 ± 0.30

Table 5. The result of functional properties of data flavor

Functional properties	Value
Water absorption capacity	67.33 ± 1.93
Oil absorption capacity	79.33 ± 5.84
Bulk density	100 ± 2.70
Gelatinization	77 ^{oc}
PH	Acidic

The result of mean of the 3 determination ± SD

5 Discussion

The results obtained shown the fat composition to be found at 14.48g/100g of date but according to Liluchi and Mikil (1974), date was considered a low fat diet about 0.4%.the value obtained from protein was 20.87.87k/100g of date flour which was a very high value compared with those reported by Elleuch et al (2008) where he worked on two cultivars (Deglet nour and Allig cultivar) and obtained 2.1g and 30g of protein respectively and as such date was considered a low protein diet. Total carbohydrate content was found to be about 50% which is similar to what was reported by Elleuch et al (2008). The fibre content was 2.3g/100g of date which is too low compared to the result obtained by Elleuch et al. 2008 where 14.4g/100g on the two different cultivars were obtained. The variation in the nutritional composition may be due to difference in cultivar / biological variation, climate and environmental condition.

The consumption of tannin in large doses may cause bowel irritation, liver damage, stomach and kidney irritation and gastrointestinal pain, chelates minerals and makes them unavailable to the body. Also, polyphenols reduce the bioavailability of Fe and causes anemia (McGee 2004 and Karamac, 2009) but the level in the sample used was very low 0.0021 ± 0.0003. The value of saponins from the analysis was 0.047 ± 0.0058 which is low and is within the permissible limit of (48.50 mg/100 g) as recommended 2003 (WHO, 2003). it is evidence from this study that utilization of date palm might not post any health threat because of low value of oxalate 0.005 ± 0.012. This indicates that the fruit can be used effectively

since the anti-nutritional composition is low and there would be no interference with the nutrients like protein and minerals in the body.

The calcium magnesium 51mg/100g and 40mg/100g was higher than the result obtained by Ducuypere (2001) which is 32mg/100g and 35mg/100g respectively. The phosphorus content (42mg/100g) was lower compared to 51mg/100g reported by Ducuypere (2011). The iron content was 2.42mg/100g which was higher than 0.8mg/100g obtained by Ducuypere (2011) and as such is found to be a good source of iron as many studies have revealed. Potassium and sodium content were found to be 126mg/100g and 70mg/100g respectively value far higher than those obtained by Ducuypere (2011) which were 54mg/100g and 0.7mg/100g. The difference in value of these two research work may be due to the difference in the level of moisture content which exerts a significant influence on chemical composition of date according to Sahari et al 2007.

The result of the sensory evaluation was carried out on pap sweetened with date flour and one sweetened with granulated sugar. High sensory scores were equally recorded for the taste and flavor of both paps sweetened with date flour and one sweetened with granulated sugar.

The above interpretation of result shows that there was no significant difference in the taste and flavor mouthfeel, colour and appearance of both paps sweetened with date flour and one sweetened with granulated sugar, but there was significance difference in the texture. It can be deduced from the above discussion that if the mouth feels, colour, and other can be improved upon; the date palm fruit will be widely accepted as a sugar substitute.

Conclusion

The result showed that the product obtained can be effectively substituted for granulated sugar and can at the same time help to control the health problems that could cause by the intake of simple sugar; and it also helps to enrich the diet.

References

- [1] Al-Farsi M, Lee CY (2008). Optimization of phenolics and dietary fibre extraction from date seeds. *Food Chem.* 108:977–985.
- [2] Anhwange BA, Ajibola VO, Oniye SJ (2004). Chemical Studies of the Seeds of *Moringa oleifera* and *Deuterium microcarpum*. *J. Biol. Sci.* 4 (6):711-715
- [3] Ogunbenle HN (2011). Chemical and fatty acid compositions of date palm fruit (*Phoenix dactylifera* L.) Flour. *Bang. J. Sci. Ind. Res.*46(2):255-258.
- [4] Nagel, R.,2012. *Living With Phytic Acid. Wise Traditions in Food, Farming and the Healing Arts* j. Weston A Price Foundation.
- [5] Rock, W., M, Rosenblat, H. Borochoy-Neori, N. Volkova, S. Judeinstein, M.Elias and M.Aviram,2009. Effects of date (*Phoenix dactylifera* L., Medjool or Hallawi Variety) consumption by healthy subjects on serum glucose and lipid levels and on serum oxidative status: a pilot study, *J. Agri. Food Chem.* 57:8010-8017.
- [6] Sadiq, I., T.Izuagie, M. Shuaibu, A.Dogoyaro, A., and S. Abubakar, 2013. The Nutritional Evaluation and Medicinal Value of Date Palm (*Phoenix dactylifera*). *International Journal of Modern Chemistry*, 4(3): 147-154.
- [7] Hassan LG, Umar KJ (2004). Proximate and Mineral Composition of Seeds and Pulp of African Locust Bean (*Parkia biglobosa*). *Nig. J. Basic Appl. Sci.* 13:15-27.
- [8] Umar HA, Adamu R, Dahiru A, Nadro MS (2007). Level of Antinutritional factors in some wild edible fruits of Northern Nigeria. *Afr. J. Biotechnol.* 6(16):1935-1938.
- [9] E. Y. Shaba*, M. M. Ndamitso, J. T. Mathew, M. B. Etsunyakpa, A. N. Tsado and S. S Muhammad (2015). Nutritional and anti-nutritional composition of date palm (*Phoenix dactylifera* L.) fruits sold in major markets of Minna Niger State, Nigeria, *African Journal of Pure and Applied Chemistry*, Vol. 9(8), pp. 167-174,
- [10] Walid Al-Shahib, Richard J, Marshall. (2003) The fruit of the date: its possible use as the best food for the future? *Int. j.of food Science and Nutr.* 54(4):247-59.
- [11] Huang W, and H.J. Lantzsch (1983). Sensitive method for the rapid determination of phytate in cereal and cereal products *J.Sci. food Agric.* 34:1423-1426.
- [12] Day R, and A. Uderwood (1986). *Quantitative Analysis* 5th ed. Prontice-Hall Publication.p.701.

- [13] Association of Official Analytical Chemist (A.O.A.C) 1984. Official Method of Analysis of the Association Official Analytical Chemist. 14th edition. INC III, North Nineteenth Street, Suite 210 Arlington VA 222-113. Pg 187-188
- [14] Brunner J.H. (1984): direct Spectrophotometer determination of Saponin. Analytical chemist 34, pg.1314-1326
- [15] Elleuch M., 2008. Date flesh chemical composition and characteristic of dietary fibre. Food chem. 111:676-668
- [16] WHO (2003). Feeding and Nutrition of Infants and Young Children: Guidelines for the WHO European region with emphasis on the former Soviet Union. WHO Regional Publications, European Series. 87:1-296.
- [17] Karamac, M., 2009. Chelation of Cu (II), Zn (II) and Fe (II) by tannin constituents of selected edible nuts. Intr. J. Mol. Sci. 10: 5485-97.
- [18] McGee, H., 2004. Food and Cooking: The Science and Lore of The Kitchen. New York: Scribner. 714.
- [19] Ducuypere J.D. (2011). Nutrient Charts: health-alternative.com/nutrient-chart-e-book.htm: <https://www.researchgate.net/publication/25937272>
- [20] Kikuchi N and Miki T (1974). The separation of date (Phoenix dactylifera) sterols by liquid; J. Agr. chem. soc; 48, 137.
- [21] Maga, J.A., 1982. Phytate: Its chemistry, Occurrence, Food interactions, nutritional significance and Method of Analysis. <http://agris.fao.org/agris-search>
- [22] Suresh C, Samsher S, Durvesh K (2015). Evaluation of functional properties of composite flours and sensorial attributes of composite flour biscuits. J. food Sci Technol, 52(6); 3681-3688.
- [23] Wijesinghe J.A, Wicramasinghe I, Saranandha K.U (2016). Effect of different modification methods on Gelatinization properties and analysis content of kithul (Caryota urens) flour. Pakistan J. of Nutr. Vol15 (4);312-318