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# COMPARATIVE PROXIMATE ANALYSIS OF SOME DATE PALM CULTIVARS *(Phoenix dactylifera* l.)

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**ABSTRACT**
Comparative proximate analyses of five samples of date palm cultivars *Phoenix dactylifera* were carried out. The experimental was laid on Complete Randomized Design (CRD) with three replications on each sample.The fleshes were separated from the seeds, rinsed with distilled water and dried for 24 h at 40°C. Proximate analysis, mineral composition and vitamin C content of the fruit flesh were evaluated. Moisture and ash contents were determined using oven drying method, crude protein (Kjeldahl method), crude fat (dry extraction), fibre (acid-alkaline digestion), sugar (phenol-sulphuric acid), calcium and magnesium (atomic absorption spectrometry), sodium (Flame photometry) and vitamin C using dichlorophenol-indophenol. The result of the analysis shows that sucker seed garden had the highest amount of fibre (2.17g/100g), crude fat (0.59g/100g), and Magnesium content (2482.42mg/kg). $F_4$ $R_{16}$ $GP_{III}$ had the highest amount of crude protein (3.45g/100g), sugar (79.40%), and Calcium content (13012.43mg/kg). Based on the analyses conducted, it was concluded that sucker seed garden and $F_4$ $R_{16}$$GP_{III\ had}$ the highest nutritional contents in most of the nutrients assessed. It was also observed that, date palm contains many minerals in the fruit such as sodium, potassium, calcium and magnesium in considerable amount. However, it was also seen that the different cultivars of dates contain different amount of nutrient. Antioxidants and phytochemicals analyses of this fruit are suggested to be carried out, to reveal the bioactive compounds present and proper research on medicinal and health benefit comparing different varieties of date palm is encouraged to be studied.

**Keywords**: Date palm, Proximate analysis, Minerals, Sucker seed garden, oven drying.

## INTRODUCTION

Date palm *(Phoenix dactylifera* L.) belongs to Arecaceae family and it is considered a symbol of life in the desert, because it tolerates high temperature, drought and salinity more than many other fruit crops. It originated from its fruit 'phoenix' presumable derived from the greek word for purple or red fruit, and *"dactylifera*" from the greek word "daktulos" meaning finger like appearance of the fruit form. Date palm has been cultivated in the Middle East and North Africa (MENA region) for millennia, however, the exact origin of date palm has not been verified. In Christianity, the palm leaves are used for celebration of Easter Sunday (Zohary and Hopf, 2000). In Islam the date palm was cited 21 times in the holy Qur'an and 300 times in the Hadith of the Prophet Muhammad (S.A.W), making it by far the most frequently cited plant (Musselman, 2007). Date is one of the oldest known fruit crop and has been cultivated in North Africa and the Middle East for at least 5000 years (Johnson, 2010).

Today, the date palm is found in both the Old World (Near East, North Africa and Spain) and the New World (Australia and American continent) where dates are grown commercially in large quantities (Johnson, 2010). The distribution of date palm according to latitude for both Northern and Southern hemispheres are between 10°N (Somalia) and 39°N (Elche/Spain or Turkmenistan). Favorable areas are located between 24° and 34°N (Morocco, Algeria, Tunisia, Libya, Egypt, Iraq, Iran). In USA date palm is found between 33° and 35°N.As a result of climatic factors, the date palm will grow, but will not fruit properly outside the above defined geographical limits (Zohary and Hopf, 2000).

Dates are very nutritious, assimilative and energy producing. Dates provide a wide range of essential nutrients, and are a very good source of dietary potassium. The sugar content of ripe date is about 80%, the remaining consists of protein, fiber and trace elements including boron, cobalt, copper, flourine, magnesium, manganese, selenium, and zinc (Walid and Richard, 2003).

In 2012, Egypt was the largest date producing country in the World, it produced 1.47 million tones that makes 19% of the World's dates production, followed by Iran with 1,066 million tones (14%) and Saudi Arabi 1,050 million tones (14%) (FAO, 2012). Dates production in Africa was about 2.2 million MT in 2001 and 2.4 million MT in 2006 with Egypt as the highest Dates producer (Abdul-Qadir*et al.*, 2011), while in West Africa Niger is the highest producer. Nigeria is not listed among the

date producers at the international listings. Though the Sahelian and Guinea savannah zones of Northern Nigeria are known for many economic tree crops such as gum arabic, date palm, guava, mango and orange among other crops which are supported by the weather and climatic factors that favor the production of these crops has about 85.10% hectres of agricultural land but only 37.33% hectres are used (Sani *et al*., 2010).

Due to the vast economic and other importance of date palm to humanity, there is a need to carry out proximate analysis in order to reveal its nutritional values. Date palm is an important part of a healthy diet, it plays an important role in keeping the body healthy and has many benefits including; It is an excellent source of potassium, 100g contains 696 or 16% of daily recommended levels of this electrolyte. The following were objectives of these studies; (1) To determine the moisture, Ash, Fiber, Sugar, Crude protein, and crude Fat of some selected date palm lines. (2) To determine the vitamins and minerals content of some selected date palm lines.

(3) To find the variations in Moisture, Ash, Crude Protein, Fibre, Sugar and Crude Fat contents of the five date palm lines.

## MATERIALS AND METHODS:

### Sampling Site and Sample Collection:

Five fresh date fruits (*Phoenix dactylifera L*.) (F5 R28 GP 1, F8 R2 GP2, F4 R16 GP3, F17 R8 GP4, and Sucker seed garden) were collected from the storage rooms of National Institute for Oil and Date Palm Research (NIFOR), Dutse Substation, Jigawa State of Nigeria. ($11^0$ 42ˈ 04" N $9^0$ 20'31" E). Scissors was used to cut the spikelets of each date from the fruit bunches and each of the collected fruit was stored in a cleaned polythene bag, labeled and brought to the laboratory for analyses.

### Experimental Site

The collected date fruits were tested for some nutritional or chemical components in Plant Pathology Laboratory, Plant Biology Department, Faculty of Life Sciences (latitude-11˚59 00.7N to 11˚59.2N) and (longitude-8˚28 35.3E to 8˚) and Agronomy Department, Faculty of Agriculture, Bayero University, Kano. The Samples were analyzed chemically according to the official methods of analysis described by the Association of Official Analytical Chemist (A.O.A.C.)

### Experimental Design

The experimental design used was Complete Randomized Design (CRD) with three replications in each variety.

### Sample Preparation

After removing the seeds, the date flesh was rinsed with distilled water, dried for 24 h at 40°C, milled and preserved in the freezer prior to analysis (Guizani *et al*,. 2010).

### Determination of Moisture Content

Determination of moisture was carried out as described by AOAC (1990). To determine the moisture content, Oven drying method (Gul and Safdar, 2009).

Two grams of well-mixed sample was accurately weighed in a clean, dried crucible ($W_1$). The crucible was allowed in an oven at 100-105˚C for 6-12h until a constant weight was obtained. Then, the crucible was placed in the dessicator for 30 minutes to cool. After cooling, it was weighed again ($W_2$). The percent moisture was calculated by using the following formular:

%moisture, Where; $W_1$ = initial weight of crucible + sample, $W_2$ = final weight of crucible + sample

### Determination of Ash

Oven drying method (Gul and Safdar, 2009) was adopted. A clean empty crucible was placed in a muffle furnace at 600˚c for an hour, cooled in dessicator and weighed of empty crucible was noted ($W_1$). One gram of each of the sample was taken in crucible ($W_2$). The sample was ignited over a burner with the help of blowpipe, until it was charred. Then the crucible was placed in muffle furnace at 55˚C for 2-4h. The appearance of gray white ash indicates complete oxidation of all organic matter in the sample. After ash furnace was switched off, the crucible was cooled and weighed ($W_3$). The ash content in grams was obtained using the following formular;

% Ash, Difference in weight of Ash (g) = $W_3$- $W_1$

### Determination of Crude Protein

One gram of dried sample was taken in digestion flask. 10-15ml of concentrated $H_2SO_4$ and 8g of digestion mixture i.e $K_2SO_4$, $CUSO_4$ (8:1) were added. The flask was swirled in order to mix the contents thoroughly then placed on heater to start digestion till the mixture become clear (blue green in colour). It needed 2hrs to complete. The digest was cooled and transferred to 100ml volumetric flask and volume was made up to mark by the addition of distilled water. Distillation of the digest was performed in Markam still distillation apparatus. Ten milliliters of digest were introduced in the distillation tube then 10ml of 0.5N NaoH was gradually added through the same way. Distillation was continued for atleast 10min and $NH_3$ produced was collected as $NH_4OH$ in a conical flask containing 20ml of 4% boric acid solution with few drops of modified methyl red indicator. During distillation yellowish color appears due to $NH_4OH$. The distillate was then titrated against standard 0.1N HCl solution till the appearance of pink color. A blank was also run through all steps as above. Percent crude protein content of the sample was calculated by using the following formula.

$$\% \text{ crude protein} = 6.25^* \times \%N \quad (^*\text{correction factor})$$

$$\%N = \frac{(S-B) \times N \times 0.014 \times D \times 100}{\text{Weight of the sample} \times V}$$

Where; S= Sample titration reading, B= Blank titration reading, N= Normality of HCl, D= Dilution of sample after digestion, V= Volume taken for distillation, 0.014 Meq.weight of nitrogen.

### Determination of Crude Fat

Dry extraction method for fat determination was implied. It consisted of extracting dry sample with some organic solvent, since all the fat minerals e.g fats, phospholipid, sterols, fatty acids, carotenoids, pigments, chlorophyll e.t.c. are extracted together therefore, the results are frequently referred to as crude fat. Fats were determined by intermittent soxhlet extraction apparatus. Crude fat was determined by ether extract method using soxhlet apparatus. 1kg of moisture free sample was wrapped in filter paper, placed in fat free thimble and then

introduced in the extraction tube-weighed, cleaned and dried receiving beaker was filled with petroleum ether and fitted into the apparatus. Turned on water and heater to start extraction. After 4-6 siphoning ether was allowed to evaporate and beaker was disconnected before last siphoning. Transferred extract into clean glass dish with ether washing and evaporated ether on water bath. Then placed the dish in an oven at 105˚c for 2hrs and cooled it in a dessicator. The percent crude fat was determined by using the following formular: - % crude fat

**Determination of Crude Fiber**

Acid-Alkaline digestion method based on Gul and Safdar (2009) principle was adopted to determine fiber content of the different lines of date fruits.0.153g of the moisture free sample was weighed and denoted ($W_0$), it was transferred to a porous crucible which was then placed into a dosi fiber unit, 150ml of pre-heated sulphuric acid ($H_2SO_4$) solution was added, the heating elements were turned on at 90 $^0$C, it was the reduced to 30°C after it started boiling and it was left to boil for 30 minutes. The valves were opened for drainage of acid and rinsed with distilled water thrice to remove completely all acid residues from the solution.

The same procedure was used for the alkali digestion method by using Potassium hydroxide (KOH) instead of $H_2SO_4$. The sample was dried in an oven at 150°C for an hour. The sample was allowed to cool in a dessicator and the weight was taken again ($W_1$), the sample was then kept in the muffle furnace again at 55°C for 3-4 hours. The sample was cooled down in a dessicator and the final weight was taken ($W_2$). The fiber content of each line was gotten using the following formula;

$$\text{Crude fiber} = W_1 - W_2$$

**Test for Sugar Content**

Phenol-sulphuric acid method as described by Wajda, (2014) was adopted to determine the sugar content of the date fruits.

The different varieties of date fruits were crushed using motar and pestle, 2.0g of each variety was weighed, transferred into 200ml beaker and water was added to nearly 100ml. 3ml of concentrated sulphuric acid was added into the sample carefully and was allowed to boil for 3 minutes on top of a hot plate. After boiling the sample was filtered into a 250ml volumetric flask using fluted filter paper.2.5ml of the prepared sample was taken into 10ml volumetric flask and water was added up to mark. 5ml of the diluted solution was taken into a 50ml conical flask, 15ml of concentrated sulphuric acid was added and 5ml of 5% phenol was added again. The solution was then poured into a clean cuvette and the absorbance was measured at 490nm using a visible spectrophotometre. The total sugar content (%) was calculated using the following formula;

(Sample weight x dilution factor) x 100

$$\text{Dilution factor} = \text{Final volume}/\text{Initial volume}$$

**Mineral Determination**

Mineral contents of the date fruits were determined by atomic absorption spectrometry, flame photometry and spectrophotometry according to the methods of AOAC (2003).

For wet digestion of sample, exactly (1.0g) of powdered sample was taken in digesting glass tube. Twelve milliliters (12ml) of $HNO_3$ was added to the samples and mixture was kept for overnight at room temperature. Then 4.0ml perchloric acid ($HClO_4$) was added to this mixture and was kept in the fumes block for digestion. The temperature was increased gradually, starting from 50$^0$C and increasing up to250-300$^0$C. The digestion completed in about 70-85 minutes as indicated by the appearance of white fumes. The mixture was left to cool down and the contents of the tubes were transferred to 100ml volumetric glass and the volumes of the contents were made to 100ml with distilled water. The wet digested solution was transferred to plastic bottles labeled accurately and stored for mineral determination.

**Determination of Calcium (Ca) and Magnesium (Mg) by Atomic Absorption Spectrometry**

The digested sample was analyzed for mineral contents by atomic absorption spectrophotometer. Different electrode lamps were used for each mineral. The equipment was run for standard solutions of each mineral before and during determination to check that it is working properly. The dilution factor for calcium is 100 and for magnesium is 10000. For determination of Mg, further dilution of the original solution was done by using 0.5ml original solution and enough distilled water was added to it to make the volume up to 100ml, also for the determination of Ca, 1.0ml lithium oxide solution was added to the original solution to unmask Ca from Mg. the concentrations of minerals recorded in terms of "ppm" were converted to milligrams (mg) of the minerals by multiplying the ppm with dilution factor and dividing by 1000 as follows:

$$MW = \frac{\text{Absorbency (ppm)} \times \text{Dry weight}}{\text{Weight of sample} \times 1000}$$

**Determination of Sodium (Na) by Flame Photometer**

Sodium analysis of the sample was done by the method of flame photometry. The same wet digested date sample solutions as used in AAS were used for the determination of Na. Standard solutions of 20, 40, 60, 80 and 100 Meq./L were used for Na. The calculations for the total mineral intake involve the same procedure as given in AAS.

**Determination of Vitamin C Content (Ascorbic Acid) using dichlorophenol indophenol**

For colourless solutions, 5ml of the sample containing about 0.1 mg of vitamin C was pipette into a boiling tube and 1ml of glacial acetic acid was added and titrated with the dye solution to a faint permanent pink colour. The titre was recorded. The titration was repeated with 5ml of water for the blank (B) and 5ml of ascorbic acid standard solution (S) and calculated the vitamin C content of the test sample.

For coloured solution, it was difficult to see the end point when a test solution was highly coloured, so 1ml of chloroform was added to the reaction mixture and the end point was obtained when a permanent pink colour was seen in the organic phase. The test and blank were treated the same way as the vitamin C.

Vitamin C of test (mg.100ml) = × concentration of standard.

## RESULTS AND DISCUSSION

**Table 1: Proximate analysis of different samples of date palm lines (*Phoenix dactylifera*)**

| Samples | Moisture (g/100g) | Ash (g//100g) | Crude protein (g/100g) | Fibre (g/100g) | Sugar content (g/100g) | Crude fat (g/100g) |
|---|---|---|---|---|---|---|
| **$F_5$ $R_{28}$ GPI** | 2.20$^{cd}$ | 45.90$^{b}$ | 2.98$^{bcd}$ | 1.78 | 74.40$^{e}$ | 0.57 |
| **$F_8R_2$ GPII** | 1.48$^{d}$ | 46.93$^{a}$ | 2.64$^{d}$ | 1.61 | 75.97$^{d}$ | 0.46 |
| **$F_4$ $R_{16}$ GPIII** | 4.58$^{b}$ | 46.83$^{a}$ | 3.45$^{a}$ | 1.82 | 79.40$^{a}$ | 0.19 |
| **$F_{17}$ $R_8$ GPIV** | 6.25$^{a}$ | 46.50$^{ab}$ | 3.42$^{a}$ | 1.95 | 78.43$^{bc}$ | 0.59 |
| **Sucker Seed Garden** | 6.17$^{a}$ | 41.10$^{c}$ | 2.79$^{cd}$ | 2.17 | 78.40$^{c}$ | 0.59 |
| **L.S.D (5%)** | 0.80 | 0.87 | 0.39 | 0.98 | 0.92 | 0.85 |

L.S.D = Least Significant Differences of Mean.

**Table 2: Mineral and Vitamin contents of different date palm lines.**

| Samples | Sodium (mg/kg) | Calcium (mg/kg) | Magnesium (mg/100g) | Vitamin C |
|---|---|---|---|---|
| **$F_5$ $R_{28}$ $GP_I$** | 893.92$^{b}$ | 10020.98$^{c}$ | 328.24$^{c}$ | 1.66$^{ab}$ |
| **$F_8$ $R_2$ $GP_{II}$** | 1409.72$^{a}$ | 6457.10$^{e}$ | 159.63$^{d}$ | 0.53$^{b}$ |
| **$F_4$ $R_{16}$ $GP_{III}$** | 762.78$^{d}$ | 13012.43$^{a}$ | 150.15$^{e}$ | 0.79$^{ab}$ |
| **$F_{17}$ $R_8$ $GP_{IV}$** | 845.84$^{c}$ | 9643.33$^{d}$ | 853.52$^{b}$ | 1.73$^{a}$ |
| **Sucker seed garden** | 663.35$^{e}$ | 11770.27$^{b}$ | 2482.42$^{a}$ | 1.23$^{ab}$ |
| **L.S.D (5%)** | 1.00 | 0.99 | 0.93 | 1.14 |

L.S.D = Least Significant Differences of Mean (5% Level)

### Determination of Moisture, Ash, Crude Protein, Sugar, Fibre and Crude Fat

#### Moisture Content

The high moisture content facilitates spoilage of dates and low moisture content will lead to dry dates not acceptable to consumers (Toutain*et al*., 2002) considered dates as soft, if they present a water content more than 30%, dry if this rate is less than 10% and half-soft if the rate is between 10 and 30%. This finding shows that the moisture contents were 6.25g/100g, 6.17g/100g, 4.58g/100g, 2.20g/100g and 1.48g/100g for $F_{17}R_8GP_{IV}$, Sucker seed garden, $F_4$ $R_{16}$ $GP_{III,}$ $F_5$ $R_{28}$ $GP_I$ and $F_8$ $R_2$ $GP_{II.}$ respectively. These values are slightly different from the observation of Barreveld, (1993) who reported that moisture content in date fruits at different stages of development was about 50-60% for sweet khalal, fleshes varied between 9.73 and 17.52g/100g. This variation may be due to difference in the variety of the date palm used. Statistical analysis ($P<0.05$) shows that there was no significant difference between $F_{17}R_8GP_{IV}$ and Sucker seed garden, also no significant difference between$F_5$ $R_{28}$ $GP_I$ and $F_8$ $R_2$ $GP_{II,}$ but there was significant difference between $F_4$ $R_{16}$ $GP_{III}$ and all the other four varieties.

#### Ash Content

Ash content is an index to the nutritive value of foods. It is also an indication of the presence of carbon compounds and inorganic compounds in the form of salts and oxides in date palm (Usman *et al*., 2015). This finding shows that, the ash content was 46.93%, 46.90%, 46.83%, 46.50% and 41.10% for the five samples used. These results are contrary to the ash range mean values of legumes which are between 2.4-5.0% by Omowunmi and Ayoade (2013). The high ash contents in dates indicate it could be used as a good source of inorganic minerals. Statistical analysis ($P<0.05$) also revealed that there was no significant difference between $F_{17}R_8GP_{IV}$, $F_4$ $R_{16}$ $GP_{III}$ and $F_8$ $R_2$ $GP_{II,}$ also no significant difference between $F_8$ $R_2$ $GP_{II}$ and $F_5$ $R_{28}$ $GP_{I,}$ but there was significant difference between Sucker seed garden and all the other four varieties.

#### Protein Content

In Human diet, protein quality and quantity are of major concerns. WHO/FAO suggests a daily intake of 0.88g of protein per kg body weight for children in the age range of 1-10 years (Muhammad *et al*., 2010). This finding shows that, the crude protein contents were 3.42g/100g, 3.45g/100g, 2.98g/100g, 2.64g/100g, and 2.79g/100g for $F_{17}R_8GP_{IV}$, $F_4$ $R_{16}$ $GP_{III}$, $F_5$ $R_{28}$ $GP_I$, $F_8$ $R_2$ $GP_{II}$ and Sucker seed garden respectively. This result is similar to the finding of Borchani *et al*., (2010) who analyzed eleven Tunisian cultivars of date for protein and found the highest protein content of 2.85g/100g. However, this result is contrary to the work of Al-Hooti *et al*., (1995) who reported that dates were not considered as a good source of protein. Statistical analysis ($P<0.05$) also shows that there was no significant difference between $F_{17}R_8GP_{IV}$ and $F_4$ $R_{16}$ $GP_{III,}$ also no significant difference between $F_8$ $R_2GP_{II}$, $F_5$ $R_{28}$ $GP_I$ and Sucker seed garden.

**Sugar Content**

Sugars are the most important constituents of date, making them a rich source of energy for the human system (Khan *et al*., 2008). The most important carbohydrate components in date fruit are glucose, fructose and sucrose, which can reach up to 70–80% (Nehdi *et al*., 2010, Ashraf *et al*., 2011, Baliga *et al*., 2011, Vayalil *et al*., 2012). This study shows that, the sugar contents of $F_4\,R_{16}\,GP_{III}$, Sucker seed garden, $F_{17}R_8GP_{IV}$, $F_8\,R_2\,GP_{II}$ and $F_5\,R_{28}\,GP_I$ were 79.40%, 78.40%, 78.43%, 75.97% and 74.40% respectively. This result is similar to the findings of (Borchani *et al*., 2010) who analyzed the main chemical components of date fruits from 11 Tunisian cultivars and found that they were rich in sugar (799.3–880.2 g kg-1 dry matter). Ali *et al*., (2009) also found that the total sugar concentration in three Omani date cultivars ranged from 685.3 to 753.7 g kg, the highest level being observed in 1 Khalas cultivar. Amoros *et al.*, (2009) also found that, the total sugar concentration in Caqui 24 and Caqui 22 date fruits ranged from 424 to 542 g kg. Mikki, (1999) reported that 1 Saudi date variety contained about 70% reducing sugars with and almost equal quantity of glucose and fructose. These variations in the carbohydrate concentration of date fruits could be attributed to differences in cultivar, harvest/postharvest factors, growing environment, temperature, humidity, fertilizer usede.t.c. (Nehdi*et al*., 2010; Ashraf *et al*., 2011; Baliga*et al*., 2011; Saffi*et al*., 2008; Ali *et al*., 2009 andHasnaoui*et al*., 2011). Statistical analysis ($P<0.05$) shows that, there was no significant difference between $F_{17}R_8GP_{IV}$ and Sucker seed garden, but significant difference exits between $F_{17}R_8GP_{IV}$, $F_8\,R_2\,GP_{II}$ and $F_5\,R_{28}\,GP_I$ and $F_4\,R_{16}\,GP_{III}$.

**Fibre Content**

Fiber cannot be neglected as it decreases serum cholesterol levels, risk of coronary heart diseases, hypertension, diabetes, colon and breast cancer (Ishida et al., 2000). Date fruit can be considered as a good source of dietary fibre such as cellulose, hemicellulose, lignin, pectin, etc. (Biglari, 2009; Habib *et al*., 2011). Dietary fibre is known to influence digestion and absorption processes in the small intestine. This finding shows that, the fibre contents were 2.17g/100g, 1.82g/100g, 1.95g/100g, 1,61g/100g and 1.78g/100g for Sucker seed garden, $F_4\,R_{16}\,GP_{III}$, $F_{17}R_8GP_{IV}$, $F_8\,R_2\,GP_{II}$ and $F_5\,R_{28}\,GP_I$ which is contrary to the finding of Al-Shahib *et al.*,(2002) who surveyed the total dietary fibre contents of 13 date varieties from various countries and found higher percentage of total dietary fibre in the range of 6.4–11.5%.Elleuch *et al*., (2008) also reported that, the dietary fibre concentration of two Tunisian date cultivars; Deglet-Nour and Allig were 14.4 and 18.4% respectively. Borchani *et al*., (2010) found that the fibre concentration in 11 Tunisian cultivars ranged from 80.9 to 202.5 g kg. These two results are contrary to our finding. This variation could depend on the variety and degree of ripeness. Statistical analysis ($P<0.05$) shows that, there were no significant differences in all the five varieties analyzed.

**Fat Content**

The analysis of fat content shows that, the crude fat contents were 0.59g/100g, 0.59g/100g, 0.57g/100g, 0.46g/100g, 0.19g/100g for Sucker seed garden, $F_{17}R_8GP_{IV}$, $F_5\,R_{28}\,GP_I$, $F_8\,R_2\,GP_{II}$ and $F_4\,R_{16}\,GP_{III}$. The low level of fat content with its high contents of sugar make the date palm safe for the heart and high blood pressure patients because it contains a low level of fatty acids and cholesterol. Statistical analysis ($P<0.05$) shows that there was no significant difference in all the five varieties.

**Vitamin C Content**

Date fruits are also good sources of vitamin. Vitamins are essential micro-nutrients for organisms' multiple biochemical reactions. The analysis of vitamin C contents shows 1.73mg/100g, 1.66mg/100g, 1.23mg/100g, 0.79mg/100g and 0.53mg/100g for $F_{17}R_8GP_{IV}$, $F_5\,R_{28}\,GP_I$, Sucker seed garden, $F_4\,R_{16}\,GP_{III}$ and $F_8\,R_2\,GP_{II}$ respectively. Statistical analysis ($P<0.05$) shows there was no significant difference between $F_5\,R_{28}\,GP_I$, $F_4\,R_{16}\,GP_{III}$, $F_{17}R_8GP_{IV}$ and Sucker seed garden, also there was no significant difference between $F_5\,R_{28}\,GP_I$, $F_8\,R_2\,GP_{II}$, $F_4\,R_{16}\,GP_{III}$ and Sucker seed garden.

**Mineral Content**

Minerals play many vital roles, working synergistically with vitamins, enzymes, hormones and other nutrient cofactors to regulate literally thousands of the body's biological functions. Proper blood formation, energy production, nerve transmission and regulation of healthy acid-alkaline balance are among these essential functions. Minerals also support healthy bones and teeth and are required for proper support of the body's overall structure and function.

**Sodium**

The analysis shows that, the sodium content was; 1409.72mg/kg, 893.92mg/kg, 847.84mg/kg, 762.78mg/kg and 663.35mg/kg for $F_8\,R_2\,GP_{II}$, $F_5\,R_{28}\,GP_I$, $F_{17}R_8GP_{IV}$, $F_4\,R_{16}\,GP_{III}$ and Sucker seed garden. The highest value recorded was 1409.72mg/kg for $F_8\,R_2\,GP_{II}$ and Sucker seed garden had the lowest value of 663.35mg/kg.

**Calcium**

Calcium content analysis were 13012.43mg/kg, 11770.27mg/kg, 10020.98mg/kg, 9643.33mg/kg and 6457.10mg/kg for $F_4\,R_{16}\,GP_{III}$, Sucker seed garden, $F_5\,R_{28}\,GP_I$, $F_{17}R_8GP_{IV}$ and $F_8\,R_2\,GP_{II}$. $F_4\,R_{16}\,GP_{III}$ had the highest calcium content of 13012.43mg/kg while $F_8\,R_2\,GP_{II}$ had the lowest calcium content of (6457.10mg/kg).

**Magnesium**

Magnesium content analysis was 2482.42mg/kg, 159.63mg/kg, 853.52mg/kg, 328.24mg/kg and 150.15mg/kg for Sucker seed garden, $F_8\,R_2\,GP_{II}$, $F_{17}R_8GP_{IV}$, $F_5\,R_{28}\,GP_I$ and $F_4\,R_{16}\,GP_{III}$. Sucker seed garden had the highest magnesium content (2482.42mg/kg) while $F_5\,R_{28}\,GP_I$ had the lowest (150.15mg/kg). Calcium content was the highest (13012.43mg/kg) then magnesium (2482.42mg/kg) and sodium (1409.72mg/kg). Statistical analysis ($P<0.05$) shows that there was significant difference in sodium, calcium and magnesium contents in all the five varieties.

## CONCLUSION

- In all the five varieties analysed; $F_{17}$ $R_8$ GPIV has the highest moisture content (6.25g/100g) while $F_8R_2$ GPII contains the lowest amount of moisture (1.48g/100g), $F_8$ $R_2$ GPII has the highest ash content (46.93g/100g) while Sucker Seed Gardencontains the lowest amount of ash content (41.10g/100g), $F_4$ $R_{16}$ GPIIIhas the highest crude protein content (3.45g/100g) $F_8$ $R_2$ GPI contains the lowest amount of moisture (2.64g/100g), Sucker Seed Garden has the highest Fibre content (2.17g/100g) while $F_8R_2$ GPII contains the lowest fibre(1.61g/100g), $F_4$ $R_{16}$ GPIII has the highest sugar content (79.40g/100g) while $F_5$ $R_{28}$ GPI contains the lowest sugar (74.40g/100g) and $F_{17}$ $R_8$ GPIV and Sucker Seed Garden have the highest crude fat content (0.59g/100g) each, while $F_4$ $R_{16}$ GPIII contains the lowest crude fat (0.19g/100g),
- Analysis of minerals and vitamin C contents revealed that:$F_5$ $R_{28}$ $GP_I$ contains higher sodium(893.92 mg/kg) while Sucker seed garden contains lower amount(663.35mg/kg), Sucker seed garden contains highest amount of calcium(11770.27mg/kg) but $F_8$ $R_2$ $GP_{II}$ contains the smallest amount (6457.10mg/kg),Sucker seed garden contains highest amount of magnesium (2482.42mg/kg) and $F_4$ $R_{16}$ $GP_{II}$ co ntains the lowest amount (150.15mg/kg),$F_{17}$ $R_8$ $GP_{IV}$ cont ains the highest amount of vitamin C (1.73mg/kg) while $F_8$ $R_2$ GPII contains the lowest amount (0.53mg/kg).
- Statistical analysis ($P<0.05$) of moiture content shows that there was no significant difference between $F_{17}$ $R_8$ $GP_{IV}$ and Sucker seed garden, also no significant difference between $F_5$ $R_{28}$ $GP_I$ and $F_8$ $R_2$ $GP_{II,}$ but there was significant difference between $F_4$ $R_{16}$ $GP_{III}$ and all the other four varieties, there was no significant difference between $F_{17}$ $R_8$ $GP_{IV}$, $F_4$ $R_{16}$ $GP_{III}$ and $F_8$ $R_2$ $GP_{II,}$ also no significant difference between $F_8$ $R_2$ $GP_{II}$ and $F_5$ $R_{28}$ $GP_{I,}$ but there was significant difference between Sucker seed garden and all the other four varieties for ash content analysis. However, there was no significant difference between $F_{17}$ $R_8$ $GP_{IV}$ and $F_4$ $R_{16}$ $GP_{III,}$ also no significant difference between $F_8$ $R_2$ $GP_{II}$ , $F_5$ $R_{28}$ $GP_I$ and Sucker seed garden for protein content analysis, for sugar content, there was no significant difference between $F_{17}$ $R_8$ $GP_{IV}$ and Sucker seed garden, but significant difference exits between $F_{17}$ $R_8$ $GP_{IV}$, $F_8$ $R_2$ $GP_{II}$ and $F_5$ $R_{28}$ $GP_I$ and $F_4$ $R_{16}$ $GP_{III,}$ no significant differences was observerd in all the five varieties analysed for fibre and fat content analysis

However, it was suggested that, antioxidants, phytochemicals analysis, medicinal and health benefit comparisons of different varieties of date palm should be carried out. As $F_{17}$ $R_8$ $GP_{IV}$contains higher vitamin C content, it was also recommended for people with vitamin C deficiencies to be used as vitamin supplement.

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