PHOENIX DACTYLIFERA FRUIT: A NUTRACEUTICAL AGENT IN THE TREATMENT OF DIARRHEA

BRIGHT CHIMA MEGBO 1, SAMUEL AMOS MESHACK1, DANIEL WUYANG DIO2

1Department of Biological sciences, Federal University, Wukari, Nigeria. 2Department of Biochemistry, Modibbo Adama University of Technology, Yola, Nigeria. Email: dbigdld@gmail.com

Received 2017.04.29-Accepted 2017.05.05

Abstract
The growing need for safe and accessible drugs for various ailments in the third world countries have drawn scientific minds to evaluating scientific bases of the use of some plant materials in traditional medicines. Food substances are chief among these plant materials owing to their safety and nutritional benefits aside the purported medicinal claims. The main objectives of this study were to determine the proximate nutritional composition and the antidiarrheal activity of aqueous fruit extract of Phoenix dactylifera L. (date palm).

Methods: Antidiarrheal activity of the Phoenix dactylifera aqueous fruit extract was evaluated on castor oil induced diarrhea in male wistar rats using Loperamide (standard drug) as control. The proximate nutritional composition of the fruit was determined standard laboratory methods and the antinutritional factors in the fruit were determined using standard Spectrophotometric method.

Result: The result of the nutritional analysis revealed that the date fruit contain high carbohydrate content and relatively high crude ash content and low antinutrients concentration. Phytochemical screening of the aqueous fruit extract revealed the presence of saponins, tannins, glycosides, flavonoids and alkaloids. The acute toxicity test showed that the extract is practically non toxic. The antidiarrheal activity of the aqueous fruit extract was found significant (P < 0.05) at 1000mg/Kg and 2000mg/Kg body weight.

Conclusion: The result of this research showed that Phoenix dactylifera L. (date palm) fruit can be used as an effective nutraceutical in the management and treatment of diarrhea especially in the third world countries.

Key word: Phoenix dactylifera, Diarrhea, Loperamide, Antidiarrheal activity

INTRODUCTION
Diarrhea can be defined as a symptom of the gastrointestinal disorder, characterized by increase in stool frequency and alteration in consistency resulting from imbalance between the absorptive and secretory mechanisms in the intestinal tract accompanied by hyper motility, bringing about excess loss of body fluids and electrolytes in feces (Sharma, et al., 2015). Diarrhea is the second most common cause of deaths in children younger than five (CDC, 2013) and is most common in the third-world countries (Emudainowho, et al., 2015) where over five million children (under five) die annually from its complications (Sabiu and Achema, 2016). The most common cause of diarrhea is an infection of the intestines by virus, bacteria or other parasites contracted through contaminated food or water (WHO, 2013). A number of non-infectious causes may also result in diarrhea, including hyperthyroidism, lactose intolerance, inflammatory bowel disease, a number of medications, and irritable bowel syndrome (Doyle, 2013).

Many of the drugs used in the treatment of diarrhea are expensive in view of the economic status of the third world countries. Some of the antibiotics used as antidiarrheal drug, beside their high costs, sometimes show some adverse effects and with microorganisms developing resistance towards them (Rahman, et al., 2015). In view of the relatively high cost of orthodox medicines in the developing countries and their noxious effects, the World Health Organization has approved the use of traditional (folklore) medicines in the treatment of many ailments (Gutiérrez et al., 2013). Many plants materials of nutritional qualities are being used in the folklore medicine owing to their availability and safety; one of these plant materials is Phoenix dactylifera fruit.

Phoenix dactylifera (Date palm) is an important plantation crop for many countries extending from North Africa to the Middle East including many states of the Arabian Gulf Cooperation Countries (GCC) where it is valued as a staple diet (sale et al., 2011). Date palm (Phoenix dactylifera) belongs to the Arecaceae botanical family, which contains about 200 genera with around 3,000 species (El-Far et al., 2016). Phoenix dactylifera fruit is valued for both nutrition and medicinal properties. Suleiman et al., (2012) posited that Date fruits have high carbohydrate content and higher protein content than many fruits that includes apples, oranges, bananas, grapes etc. The fruit contain a good percentage of dietary fibre and serves as good source vitamins C, B1, B2, A, riboflavins and niacin and mineral elements such as iron, potassium, selenium, and calcium (Parvin, et al., 2015). The fruit is used in the traditional medicine to counteract alcohol intoxication, to relieve fever, cystisis, gonorrhea, edema, liver and abdominal troubles especially diarrhea (Barh and Mazumdar, 2008).

Many studies have established scientifically, the antiviral, antifungal, antioxidant, antihyperlipidmic and hepatoprotective activity of Phoenix dactylifera fruit (Wan Ismail and Mohd Radzi, 2013). However, many of its medicinal properties, including anti-diarrheal effect is still obscure. This research was undertaken to establish the nutritional and antidiarrheal effect of Phoenix dactylifera

EXPERIMENTAL SECTION
Materials

Plant material
Dried date palm (Phoenix dactylifera) fruits were obtained from the local market in Wukari, Taraba State, Nigeria.

Experimental animals
Male Wister rats weighing 150-400g were used for the experiment. The animals were kept under laboratory conditions of temperature (25°C) with a 12-hour light and dark cycle. The animals were housed in animal house acclimatized for two weeks before the commencement of the experiment. The animals were fed with standard pelleted rat feed with drinking water ad libitum. All experiments were
Conducted in accordance with the principles and guide for the care and use of laboratory animals (NRC, 1996).

**Preparation of Phoenix dactylifera Fruit Extract**

The flesh of the dried *P. dactylifera* were manually separated from the pits and pounded to powder. Exactly 500g of the powder was soaked in two liters of distilled water in a conical flask. After 24 hours, the solution was filtered using a laboratory filter paper and funnel. The extract was dried in an evaporating dish at 60°C in a Carbolite oven.

**Phytochemical and Anti-nutrient Screening**

Phytochemical screening of aqueous fruit extract of *P. dactylifera* was conducted using a method described by Trease and Evans (2002), while the anti-nutrient screening was carried out by Spectrophotometric method as described by Griffiths and Thomas 1981.

**Proximate Analysis**

The proximate analysis for the flesh of *P. dactylifera* was carried out using the method described by the Association of Official Analytical Chemists (AOAC) 2006.

**Acute Toxicity (LD₅₀) Study**

Acute toxicity study was carried out using the method of Lorke (1983). In the first phase, nine rats were randomly divided into three groups of three rats per group and were given 10, 100, and 1000mg of the extract per body weight (Kg) of the rats by oral gavages respectively. The rats were observed for signs of adverse effect and death after 24 hours of administration.

In the second phase of the study, three other rats were randomly divided into three groups of one per group and given 1600mg/kg, 2900mg/kg and 5000mg/kg of the extract orally, respectively. The rats were observed for signs of toxicity and mortality after 24 hours.

**Antidiarrheal Activity Study**

Diarrhea was induced in rats by oral administration of castor (3ml/kg, p.o) as described by Abel et al., (2013) with some modifications. Before the commencement of the experiment, the rats were fasted for 16 hours but allowed free access to water ad libitum and randomly allocated into five groups of five rats per group. Each rat was subsequently separated placed in a plastic cage lined at the bottom with a blotting paper. Groups 1, 2, and 3 were given graded doses of the aqueous date fruit extract (ADFE) (500mg/kg, 1000mg/kg and 2000mg/kg respectively). Group 4 were individually given 10ml/kg body weight of distilled water which served as the control. Group 5 were given Loperamide hydrochloride (10mg/kg). One hour after pretreatment of the animals with doses of the ADFE, distilled water and Loperamide hydrochloride, all the rats in the groups were given 1ml of castor oil orally to induce diarrhea. Thereafter, the animals were observed for four hours for the presence of characteristic diarrheal droppings. At the end of the experiment, the group means were obtained and the percentage of protection calculated using the formula:

\[
\% \text{Protection} = \left( \frac{\text{Control mean} - \text{Test mean}}{\text{Control mean}} \right) \times 100
\]

**Data and Statistical Analysis**

Data obtained were presented as means (±SEM) for the number in each group (n=5). Data obtained from distilled water treated control rats were used as baseline values. In all cases, the result obtained from extract and reference drug treated test animal groups were compared with that obtained from distilled water (vehicle) treated control animal groups. The differences obtained from test animal groups and the data obtained from vehicle treated control animal groups were subjected to one – way analysis of variance (ANOVA); 95% confidence interval and followed by Dunnett’s post hoc test. In all cases, statistical significance was established at values of P < 0.05. Results obtained were analyzed using the Statistical Package for Social Sciences (SPSS version 20.0).

**RESULTS AND DISCUSSION**

The results of the proximate analysis of the pulverized dry sample of the flesh of the *P. dactylifera* fruit is shown in Table 1. The result revealed that the moisture content of the sample (flesh of *P. dactylifera* fruit) was 7.65%. This value, lower than 11.0% reported by Ogungbenle (2011) shows that this specimen may not be more inclined to decay since nourishments with high moisture content are more inclined to perishability (Shaba et al., 2015). The ash content of the sample was 6.15% which is high when compared to those reported by Shaba et al., (2015) and Ogungbenle, (2011) (1.88±0.03% and 3.27±0.02% respectively). The crude fibre content was found to be 4.30% which is similar to 4.34±0.03 and 4.00±0.02 obtained by Ogungbenle (2011) and Rehman et al., (2012). Crude fibre decreases the absorption of cholesterol from the gut in addition to delaying the digestion of lipids and conversion of starch to simple sugars, an important factor in the management of diabetes and ischemic heart diseases (Cust et al., 2009; Shaba et al., 2015). The crude protein content was 3.94%. Protein serves as enzymatic catalyst, mediate cell responses, control growth and cell differentiation (Whitney and Rolles, 2005; Shaba et al., 2015). Fat content of 1.15% was recorded from the analysis. The sample is very rich in carbohydrate (NFE) with 76.81%, thus making it a good diet for heavy workers.

### Table 1: Proximate Analysis Result. Weight (g) per 100 grams of the sample

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>7.65</td>
</tr>
<tr>
<td>Crude protein</td>
<td>3.94</td>
</tr>
<tr>
<td>Crude fibre</td>
<td>4.3</td>
</tr>
<tr>
<td>Crude fat</td>
<td>1.15</td>
</tr>
<tr>
<td>Crude ash</td>
<td>6.15</td>
</tr>
<tr>
<td>Nitrogen Free Extractives</td>
<td>76.81</td>
</tr>
</tbody>
</table>

Anti-nutritional analysis showed oxalate at 200.00mg/100g, phytic acid 35.84mg/100g and tannins 1.19mg/100g of the sample (Table 2). These values are not high enough to cause substantial interference in the absorption of nutrients like protein and mineral elements in the gut (Shaba et al., 2015)

### Table 2: Quantitative Anti-nutritional Factors Analysis

<table>
<thead>
<tr>
<th>Anti-nutritional Factor</th>
<th>Weight (mg/100g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxalate</td>
<td>200</td>
</tr>
<tr>
<td>Phytic acid</td>
<td>35.84</td>
</tr>
<tr>
<td>Tannins</td>
<td>1.19</td>
</tr>
</tbody>
</table>

Phytochemical analysis of the aqueous extract of *P. dactylifera* produced positive reactions for each of the following: saponin, tannins, glycoside, flavonoid and alkaloid (Table 3). Tannins, flavonoids, saponins and alkaloids have been reported to possess antidiarrheal activity and therefore support the speculation of antidiarrheal activity of the *P. dactylifera* fruit (Longanga et al., 2000; Akudor et al., 2011; Abel et al., 2013).

### Table 3: Phytochemical Analysis of the Aqueous Extract of *P. Dactylifera*

<table>
<thead>
<tr>
<th>Constituents</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saponin</td>
<td>+</td>
</tr>
<tr>
<td>Tannins</td>
<td>+</td>
</tr>
<tr>
<td>Saponins</td>
<td>-</td>
</tr>
<tr>
<td>Glycosides</td>
<td>+</td>
</tr>
<tr>
<td>Anthraquinone</td>
<td>-</td>
</tr>
<tr>
<td>Flavonoids</td>
<td>+</td>
</tr>
<tr>
<td>Alkaloids</td>
<td>+</td>
</tr>
<tr>
<td>Terpenes</td>
<td>-</td>
</tr>
</tbody>
</table>

The acute toxicity test showed that there was no mortality, restlessness or seizures observed in the experimental animals upon oral administration of the ADFE even at a high dose of 5000mg/kg showing that the LD₅₀ was above 5000mg/kg. This finding is in agreement with that of Tijani et al., (2008) and Abel et al., (2013). The absence of death and other signs of acute toxicity like restlessness or seizures after the oral administration of high dose of 5000mg/kg of the extract suggest that the extract is non-toxic acutely and is safe.

The result of the antidiarrheal test is shown in table 4. The study shows that there was significant (P < 0.05) inhibition of diarrhea and the frequency of stool with the 2000mg/kg dose showing the greatest inhibition. The standard antidiarrheal drug Loperamide (10mg/kg, p.o) produced a more marked significantly greater (p < 0.001) inhibitory effect on diarrheal frequency examined than the highest dose.
of ADFE (2000mg/kg, p.o) used. The aqueous fruit extract of Phoenix dactylifera exhibited antidiarrheal activity in this study by reverting frequency of defection and wetness of the fecal dropping induced by castor oil in wistar rats. It is possible that the extract was able to inhibit electrolyte permeability in the intestine due to castor oil and/ or through inhibition of prostaglandins release (Adzu et al., 2003; Abel et al., 2013). It can be supposed that the prostaglandin, nitric oxide, and platelet activating factor, cAMP and tachykinins synthesis inhibition might be involved in the mechanism of action (Emmanuel et al., 2011).

Although Abel et al., (2013) reported that the antidiarrheal activity of ADFE in Wistar rats was not statistically significant even at 2000mg/kg as an antidiarrheal agent in prophylactic study; Phoenix dactylifera fruits has therapeutic antidiarrheal activity and can be used as a nutraceutical in the management and treatment of diarrhea.

Table4. Effects of Aqueous Extract of Phoenix dactylifera on Castor Oil induced Diarrhea in Rats

<table>
<thead>
<tr>
<th>Treatment group</th>
<th>Dose (mg/kg, p.o)</th>
<th>Number of wet stool (Mean ± SEM)</th>
<th>Percentage of protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADFE</td>
<td>500mg/kg</td>
<td>7.80 ± 3.00</td>
<td>13.33</td>
</tr>
<tr>
<td>ADFE</td>
<td>1000mg/kg</td>
<td>5.80 ± 2.30</td>
<td>44.44*</td>
</tr>
<tr>
<td>ADFE</td>
<td>2000mg/kg</td>
<td>4.60 ± 4.00</td>
<td>48.88*</td>
</tr>
<tr>
<td>Control</td>
<td>10mg/kg</td>
<td>9.00 ± 1.60</td>
<td>0.00</td>
</tr>
<tr>
<td>Loperamide</td>
<td>10mg/kg</td>
<td>0.00 ± 0.00</td>
<td>100.00*</td>
</tr>
</tbody>
</table>

One – way ANOVA + Dunnett’s post hoc test. N = 5, *P < 0.05, *P < 0.01

CONCLUSION

The anti-nutritional analysis revealed that the fruit is safe for consumption; proximate analysis showed that the fruit is a good source of carbohydrate dietary fibre and protein. The lethal dose (LD0x) value for the oral administration of ADFE was found to be greater than 5000mg/kg in Wistar rats. The phytochemical screening revealed the presence of saponin, tannins, glycoside, flavonoid and alkaloid. ADFE possess’ antidiarrheal activity on castor oil induced diarrhea in waster rats the dose of 1000mg/kg body weight.

REFERENCES