Nutritional Values of Selected Date Palm Varieties in Pakistan

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Abstract: The date palm plays an important role in human’s history due to its high nutritional values. With the advancement in worldwide utilization and industrialization of dates, they have earned great importance in human nutrition as cheapest and most abundant source of carbohydrates, proteins and other nutrients. The present study aimed to analyze the various nutritional values and biochemical analysis of different date palm varieties in Pakistan. Of the six date palm varieties, four varieties Karbala, Cobra, Aseel and Shimla were from Pakistan and two Muzawati (Iran) and Zaitoon (Saudi Arabia) were foreign varieties. The biochemical analysis of all the six varieties revealed that the moisture content ranged from 20.9-22.0%, ash 1.7-2.0%, protein 1.7-2.0%, fats 0.4-0.5%, fiber 1.8-2.3% and carbohydrates ranged from 71.5-73.9% in Pakistani varieties, while in foreign varieties the moisture ranged from 19.7-21.0%, ash 2.1-2.2%, protein 2.1-2.3%, fats 0.6-0.6%, fiber 1.9-2.0% and carbohydrates from 72.2-73.3%. The results indicated that Pakistani varieties displayed the same nutritional values as observed in several other foreign varieties and Karbala and Cobra can be grown in Pakistan as best varieties.

Key words: Date palm · Nutritional value · Carbohydrates · Varieties · Pakistan

INTRODUCTION

Date palm (Phoenix dactylifera L.) belongs to family Palmae or Arecaceae and extensively cultivated from old times for its edible fruits. They are cultivated throughout the Canary Islands, Northern Africa, Middle East (Saudi Arabia, Kuwait, Oman, UAE), Pakistan and India. More than 2,000 date varieties are identified varied in their characteristics such as colour, flavour, shape, size and ripening time [1, 2]. It is a medium-sized tree, 15–25 m tall, with pinnate leaves (3–5 m long). The hanging fruits or drupe are called as dates, which are oval to cylindrical in shape with a size of 3–7 cm long and 2–3 cm wide [3, 4]. From ancient times, the dates are considered as best food enriched with essential nutrients and having prospective health benefits. The ripened dates display very high content of carbohydrates (70-80%); the remaining consists of proteins, fats and several important minerals as iron, magnesium, copper and sulphur. A high value of fiber is available in date fruits and they are excellent potassium source. Date palm also yields several other products such as syrups, vinegar, alcohol and strong liquor [5-8]. Besides several nutritional values, the date palm also yields lactic acid [9], high fructose syrups [10], acetone-butanol-ethanol solvents [11] and several vitamins (B1, B2, B3, B5, B6, B9 and B12) in immature and mature dates [12].

Few reviews related to the pharmacological values of date palm [13] and photochemical compositions and nutritional significance of various date palm varieties [14] are available which showed the high nutritive values and potential health benefits of date fruits to human population. With the present increasing demands of world food supply, the date fruits with high dietary values could be a good source of food. Due to its high dietetic values, it remained the centre of focus since old ages. In comparison to several other fruits, dates provide maximum energy (more than 3,000 calories/kg) [15].

Considering the high demands of date palm as food and due to its high dietary values, the present study was conducted to analyze the nutritional values of Pakistani and foreign date palm varieties.
MATERIALS AND METHODS

Packed dates from six different varieties namely Karbala, Cobra, Aseel and Shimila (Sukkar and D.I. Khan, Pakistan), Muzawati (Iran) and Zaitoon (Saudi Arabia) were obtained from Peshawar city market. These biological materials were obtained in fresh conditions and were brought to the Laboratory of National Institute for Food and Agriculture (NIFA), Peshawar, Pakistan for nutritional analysis.

The date palm was chemically analyzed for their moisture, fiber, fats, proteins, ash and carbohydrates contents. The recommendations of Rangana [16] were performed for the analysis of moisture and fiber contents and that of James [17] were adopted for the analysis of ash, proteins, fats and carbohydrates. Organoleptic evaluation was performed according to the recommendations of Larmond [18].

Ten grams of date fruit mixture was taken in already weighted China dish to determine the moisture percentage. The dish was kept in oven at 105°C until a constant weight was gained. Following formula was used to calculate the moisture content.

\[
\text{Moisture (\%)} = \frac{W_i - W_2}{W_0} \times 100
\]

where \(W_i\) is the initial weight, while \(W_2\) is the final weight of sample. Moisture free samples were used for further analysis.

To calculate ash content, 2g of each date palm sample was taken in a dry china dish and charred over a slow burning flame. The samples were transferred to muffle furnace and ashed at 550°C until constant weight was obtained.

\[
\text{Ash (\%)} = \frac{\text{Difference in weight} \times 100}{\text{Weight of sample}}
\]

For crude protein determination, the Kjeldahl method was used. The samples were digested by heating with concentrated sulphuric acid in the presence of digestion mixture. A 40% w/w NaOH was added to make the mixture alkaline. The ammonia released from Ammonium sulphate was collected in 2% boric acid solution and titrated against standard HCl. Total protein was calculated by multiplying the amount of nitrogen with appropriate factor (5.70) and the amount of protein was calculated.

\[
\text{Protein (\%)} = \frac{(S-B) \times N \times 0.014 \times 100 \times 5.70}{\text{Weight of sample} \times V}
\]

where \(S\) is titration sample, \(B\) is blank titration, \(N\) is normality of the acid used and \(V\) is volume of sample taken for distillation.

For the determination of fats, dry extraction method was adopted, which consists of extracting dry sample with organic solvent. All fat materials e.g. fats, sterols, phospholipids, fatty acids, chlorophyll, carotenoids and pigments were extracted together and referred as crude fat. Soxhlet extraction apparatus was used for fats determination by taking 1g of moisture free sample in fat-free thimble. The fats were extracted repeatedly with anhydrous petroleum ether between boiling points of 40-60°C and dried at 70°C in an oven. Percentage of crude fats in the sample was calculated as:

\[
\text{Crude fat (\%)} = \frac{\text{Weight of fat}}{\text{Weight of sample}} \times 100
\]

To determine crude fiber, Ether extracted crude fiber sample was digested with dilute H\textsubscript{2}SO\textsubscript{4} and NaOH solutions and undigested residue collected after digestion was ignited. The loss in weight after ignition was registered as crude fiber.

\[
\text{Crude fibre (\%)} = \frac{\text{Loss in weight on ignition} - f}{\text{Sample weight}}
\]

Determination of carbohydrates was performed by obtaining the available carbohydrate content by calculating the entire fraction by proximate analysis.

\[
\% \text{Available carbohydrates} = 100 - [\% \text{moisture} + \% \text{ash} + \% \text{fat} + \% \text{protein} + \% \text{fiber}]
\]

For organoleptic evaluation, the sensory evaluation of flat bread was carried out according to the method of 9-point hedonic scale [18]. The date’s samples were presented to a taste panel of judges, who were asked to evaluate dates for appearance, taste, texture and odor. The overall acceptability was calculated as mean score given by a judge for these parameters according to 9-points hedonic scale.

RESULTS AND DISCUSSION

The present study was conducted to calculate the nutritional values of different date palm varieties, both native and foreign and to evaluate the quality of Pakistani date palm varieties in comparison to the nutritional values of foreign varieties. The moisture content, proteins, fats,
Dates yielded several essential nutrients and are the major source of potassium required in diet. The chemical analysis of dates moisture, ash, proteins, fats, fiber and carbohydrates contents are presented in Table 1. Six different varieties of date palm [4 Pakistani (Karbala, Aseel, Cobra, Shimla), 2 foreign (Muzawati and Zaitoon)] showed the variable nutritional values (Table 1).

The 20% moisture content of dates is the best moisture level for large scale storing and marketing of dates [15]. The present results showed that moisture content %ages in Pakistani and foreign varieties were decreased in order as Shimla 22% > Aseel 21.5% > Karbala and Muzawati 21.0% > Cobra 20.9% > Zaitoon 19.7% (Table 1). These moisture contents are perfect to store the dates and to avoid the microbial contaminations under high moisture levels, the food stuff can easily be attacked by the microbes [19]. The Pakistani varieties satisfied the moisture content (20%) of dates as mention by FAO [15] in comparison to the foreign varieties. Cobra is studied as best Pakistani variety exhibiting the least moisture contents.

From the work of different researchers on date palm, it was concluded that the flesh dates displayed several ingredients of nutritional values. The fruits of the Phoenix dactylifera displayed 2.3-5.6% protein content among various varieties [5, 6]. The Pakistani varieties displayed slightly less protein content but the maximum protein values lied in the same range as investigated in previous studies (Table 1). According to our results, proteins are present in the Pakistani and foreign varieties as Zaitoon (2.3%), Muzawati (2.1%), Cobra (2.0%), Shimla (1.9%), Karbala (1.8%), while the lowest protein content was detected in variety Aseel (1.7%). These results indicated that protein content in Pakistani varieties was comparatively less compared to foreign varieties.

The flesh dates contain less than 2% fat content [15]. The fruits of the date palm contain 0.2-0.5 percent fat contents [5]. The results of the present study showed that fats were present in both Pakistani and foreign varieties were decreased in order as Zaitoon and Muzawati varieties displayed 0.6%, while Aseel and Shimla displayed only 0.4% fats (Table 1). All varieties showed the satisfactory values <2% as mentioned by the FAO [15]. Fat content of Cobra variety (0.5%) was exactly in accordance to the results of previous study reported by Al-Shahib et al. [5].

According to FAO [15], the flesh dates contain 2.5% fiber contents. The dietary fiber of 14 varieties of dates showed 6.4-11.5 percent fiber depending on the degree of fruits ripeness and varieties [5]. In the present study, the fiber contents in both Pakistani and foreign varieties was in decreasing order as Shimla contained the maximum fiber content (2.3%), followed by Karbala (2.2%), while Cobra (1.8%) and Muzawati (2.0%) showed the minimum values for fiber contents (Table 1). The results showed that fiber detected in Pakistani varieties were in satisfactory amounts in comparison to the foreign varieties and lied in the same range (2.5%), as mentioned by FAO [15]. Another study showed slightly high values of crude fiber (4.34%) in date fruits [7], which might be due to different date variety in comparison to the used varieties. The present study revealed Shimla and Karbala as best fiber producing varieties.

Dates are highly nutritious among all the fruits and best energy source with around 70% carbohydrates [15]. The P. dactylifera fruits (dates) contained a high percentage (44-88%) of carbohydrates [5]. Due to high carbohydrates or sugar content (70–80%), nutrient enriched date fruits provide a good source of instant energy [19]. The present results indicated that carbohydrates was presented in Pakistani and foreign varieties in decreasing order as Karbala contained 73.9%, Cobra 72.8%, Aseel 72.5%, while Zaitoon and Muzawati exhibit 73.3 and 72.2% carbohydrates, respectively (Table 1). The foreign and Pakistani varieties are fulfill the carbohydrate percentage (70 percent) as mentioned by FAO reports [15]. In a previous study reported by Al-Shahib et al. [5], 44-88% carbohydrates were detected in date varieties, while 70-80% carbohydrate contents were observed in date varieties [20], which are in accordance to present study results. The present study confirmed that Karbala is the best variety in Pakistan for high carbohydrates contents followed by Cobra. In contrast the Saudi Arabian variety showed nearly same amount of carbohydrates as observed in Karbala and Shimla varieties.

Several previous studies were conducted to analyze the nutritional values, fruit characteristics and biochemical constituents of various date palm varieties. It was observed that the pollen samples of date palm

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Nutrients %</th>
<th>Karbala</th>
<th>Aseel</th>
<th>Cobra</th>
<th>Shimla</th>
<th>Muzawati</th>
<th>Zaitoon</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Moisture</td>
<td>21</td>
<td>21.5</td>
<td>20.9</td>
<td>22</td>
<td>21</td>
<td>19.7</td>
</tr>
<tr>
<td>2</td>
<td>Ash</td>
<td>1.7</td>
<td>1.8</td>
<td>2.0</td>
<td>1.9</td>
<td>2.1</td>
<td>2.2</td>
</tr>
<tr>
<td>3</td>
<td>Protein</td>
<td>1.8</td>
<td>1.7</td>
<td>2.0</td>
<td>1.9</td>
<td>2.1</td>
<td>2.3</td>
</tr>
<tr>
<td>4</td>
<td>Fats</td>
<td>0.4</td>
<td>0.4</td>
<td>0.5</td>
<td>0.4</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>5</td>
<td>Fibers</td>
<td>2.2</td>
<td>2.1</td>
<td>1.8</td>
<td>2.3</td>
<td>2.0</td>
<td>1.9</td>
</tr>
<tr>
<td>6</td>
<td>Carbohydrates</td>
<td>73.9</td>
<td>72.5</td>
<td>72.8</td>
<td>71.5</td>
<td>72.2</td>
<td>73.3</td>
</tr>
</tbody>
</table>
influenced the maternal tissues of date fruits such as shape, size, weight, percentage of pericarp and ripening time [21]. In another study, proximate composition of eight date palm varieties Daki, Halavi, Aseel, Khuzravi, Zahidi, Deglet Noor, Coconut and Barkavi indicated that these varieties are rich in carbohydrates, proteins, fats, fibres and other nutrients with low moisture and ash levels [22]. These results are in accordance with these results with almost same proportions of various nutrients in date palm varieties (Table 1). The nutritive values and economic importance of various data palm varieties were explained by Chandrasekaran and Bahkali [8], which showed that besides having nutritional values, several other products and by-products such as vitamins, ethanol, syrups etc are obtained from various date palm varieties.

The nutritional and biochemical analysis of various date palm varieties were reported by Baraem et al. and El-Sharnouby et al. [6, 23] showed high carbohydrates (62-75%) contents followed by moisture (10-22%), fibre (5-8%), ash (3.5-4.2%), protein ranged from 2.2 to 2.7%, fat 0.4% to 0.7% and total acidity ranged from 0.06% to 0.20% on dry weight basis. The values for different nutrients in present study were exactly in accordance to the values explained in previous studies [4, 5, 15]. This indicates same nutritional values of Pakistani and foreign date varieties. Our results confirmed that the Pakistani date varieties are complete source of nutrients. It is therefore recommended to cultivate varieties like Shimla and Karbala to fulfill the dietary and increasing demands of dates in Pakistan.

On the basis of organoleptic evaluation (appearance, odor, taste and texture), the best varieties in decreasing order are Karbala, Aseel, Cobra, Shimla, Muzawati and Zaitoon. Table 2 showed the Pakistani varieties, which were best with respect to appearance, taste, odor and texture of date fruits. The variety Zaitoon had high carbohydrates and protein contents but was at the lowest rank based on organoleptic evaluation criteria.

Table 2: Organoleptic evaluation in different date palm varieties

<table>
<thead>
<tr>
<th>No.</th>
<th>Varieties</th>
<th>Appearance (0-9)</th>
<th>Odor (0-9)</th>
<th>Taste (0-9)</th>
<th>Texture (0-9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Karbala (Sukkar)</td>
<td>8.0</td>
<td>7.8</td>
<td>7.9</td>
<td>8.2</td>
</tr>
<tr>
<td>2</td>
<td>Aseel (Sukkar)</td>
<td>6.5</td>
<td>6.8</td>
<td>7.1</td>
<td>7.2</td>
</tr>
<tr>
<td>3</td>
<td>Cobra (Sukkar)</td>
<td>6.1</td>
<td>5.6</td>
<td>6.2</td>
<td>6.3</td>
</tr>
<tr>
<td>4</td>
<td>Shimla (D.I. Khan)</td>
<td>6.9</td>
<td>6.8</td>
<td>7.3</td>
<td>7.0</td>
</tr>
<tr>
<td>5</td>
<td>Muzawati (Iran)</td>
<td>6.2</td>
<td>5.5</td>
<td>6.0</td>
<td>5.5</td>
</tr>
<tr>
<td>6</td>
<td>Zaitoon (Saudi Arabia)</td>
<td>3.6</td>
<td>4.8</td>
<td>5.4</td>
<td>3.9</td>
</tr>
</tbody>
</table>

CONCLUSION

The present work was a comparative study of 6 date palm varieties for the biochemical and nutritional values. It can be concluded that all the Pakistani varieties quantitatively (chemical composition) and qualitatively (organoleptic properties) are comparable to foreign varieties. Best Pakistani varieties were Cobra and Karbala, followed by Aseel and Shimla. In contrast the foreign varieties Zaitoon (Saudi Arabia) and Muzawati (Iran) also showed high dietary values. The results revealed Karbala and Cobra as the best among Pakistani varieties.

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