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Research Article
Consumption of Dates among Saudi Adults and its Association with the Prevalence of Type 2 Diabetes

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Abstract

Background and Objective: Saudi habitual eating patterns have altered recently. However, some common traditional practices remain, such as consumption of dates. Palm date is an important fruit in Saudi culture and its consumption among Saudi populations reached the highest in the world. This study was conducted to assess the amount and frequency of consumption of date among diabetic and non-diabetic participants. **Materials and Methods:** Saudi males (1044) and females (n = 1133) participated (total = 2177) in this study. Information on socioeconomic factors, anthropometric measurement, frequency of date consumption and incidence of type 2 diabetes was collected. **Results:** The results had revealed that the consumption of dates reached to 100 g days^{-1} and it could secure about 10th and 4th of the daily requirement of energy and non-starch polysaccharides, respectively. Moreover, the consumption of dates by diabetic individuals was higher than non-diabetic ones. Although, there was a small to moderate relationship between the prevalence of type 2 diabetes in both age and BMI ($p<0.001$), this association had not been observed with the consumption of dates ($p>0.05$). **Conclusion:** The study concluded that the consumption of dates had no association with the prevalence of type 2 diabetes. Further clinical trials are recommended to confirm the beneficial health effects of dates intake on blood profiles in individuals with type 2 diabetes mellitus.

Key words: Date consumption, palm date, habitual eating patterns, Saudi adults, type 2 diabetes, dates intake, chronic diseases

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Dates palm (*Phoenix dactylifera* L.) is considered as the oldest crops in the world and it has been cultivated in the Arab world for centuries[1-3]. Date palm fruits are characterized with their nutritional and functional properties. Various cultivars vary in their nutrient contents, particularly minerals and anti-oxidants, due to the differences in cultural practices and postharvest handling. Nutritionally, palm date fruits are known as a good source of simple carbohydrates and the concentration of these simple carbohydrates varies according to the cultivar, ripen stage and growth conditions[4-5]. In addition, date palm fruits are rich in dietary non-starch polysaccharide (NSPs) and certain essential minerals such as potassium and magnesium[4-5]. The simple carbohydrates in dates include mainly glucose and fructose, along with small quantity of sucrose in some date palm cultivars[6]. It is evident that some amounts of sucrose at Rutab stage starts to be converted to glucose and fructose at Tamer stage[7]. Thus, the Tamer stage is characterized with the absence of sucrose and the presence of high concentrations of fructose and glucose. Also, dates possess a potential value as a functional food due to its high content of NSPs and anti-oxidants[5,8-10]. It is evident that consumption of high fibre diet is associated with a favourable effect on insulin sensitivity and may protect against the development of type 2 diabetes mellitus[11].

There was increasing interest in estimating the consumed dates, in particular among Arab populations. The highest consumption of dates per capita was found among Saudi populations, which reached in average 33.8 kg per year[12] in 2003. In fact, Saudi populations habitually enjoy consuming dates along with Arabic coffee as a snack or with sour milk at lunch time on a daily basis[13-14]. Interestingly, despite the high content of the easily digestible carbohydrates in dates in the form of glucose and fructose, consumption of dates by healthy subjects had no effect on serum glucose and triglycerides[15]. Indeed, dates are widely used in folklore to treat diabetes and hypertension[16]. This is consistence with the findings related to the glycaemic index (GI) for the most of dates cultivars, which found to be low to moderate[13-14,17-20]. The GI is a qualitative tool for classifying starchy foods according to their physiological impact on blood glucose levels[21-22]. Intervention and epidemiological studies showed that the high consumption of low GI foods and NSP was associated with the reduction of type 2 diabetes mellitus (T2DM) risk[23-27].

The number of people with diabetes mellitus (DM) in the world is expected to rise from 2.8% in 2000 to 7.7% in 2030 due to population growth, aging, effects of modernisation, increase prevalence of obesity and decrease physical activity[28-29]. In Saudi Arabia, a few epidemiological studies have been carried out and these have revealed that the prevalence of DM was high relative to other countries[30-34]. Nearly 5% of all deaths in the Saudi Arabia are attributed to diabetes, in which is considered as the 6th leading cause of death[35].

Many factors are involved in influencing the prevalence of DM such as gender, age, socioeconomic status, genetic susceptibility and lifestyle. In Saudi Arabia, two of the main reasons for the increase of DM may be the increase in obesity and a major change in habitual eating patterns, including modifications in the quality and quantity of dietary carbohydrates[36-37]. It is well documented that T2DM has shown to be strongly associated with obesity and an inactive lifestyle[38-40]. The overall prevalence of obesity among Saudis was projected to increase from around 12% in 1992 to 41% by 2022 in males and from 21-78% in females[33].

Dates palm is still underexploited as a functional or healthy food[10,41-42]. One of the major concerns among health professionals and the public is whether regular consumption of dates increases the risk of chronic diseases such as diabetes, however; dates could be used as part of a regular diet for healthy people and presumably for the patients with diabetes as well[10]. Majority of scientists and public believed that diabetic patients should avoid consumption of date due to its high contents of simple sugars such as glucose, despite the fact that the impact of most of dates cultivars on blood glucose in healthy and diabetic subjects was low[14,18]. Therefore, this study aimed to assess the amount and frequency of consumption of dates among diabetic and non-diabetic Saudi population in Eastern province of Saudi Arabia.

MATERIALS AND METHODS

A cross-sectional survey using a collection data form was conducted on 2224 selected Saudi male and female adults from eastern province, Saudi Arabia between February and April 2017. The response rate was 97.8% (2177 of 2224). The collection data form, composed of socioeconomic factors, anthropometric measurement, incidence of type 2 diabetes and dates consumption was applied. Height and weight were recorded and the body mass index (BMI; kg/m^2) was calculated from weight in kilograms divided by the square of the height in meters. Self-reported diabetes was applied through asking participants whether they had type 2 diabetes diagnosed by a doctor or nurse.

This study was part of a project, which its protocol was approved by King Faisal University Ethics Committee (ERB/0001-Year 2015).

Participants were asked to state the amount and frequency of consumption of date (at Rutab and Tamer stages). They were also asked to indicate if the dates were consumed daily, weekly, monthly or rarely/never[43-46]. The number of consumed dates was multiplied by 9 (assuming that the average weight of date = 9 g). Then the consumption of dates was described on a daily basis by dividing the amount in grams by the number of days. The nutrients of consumed dates were analyzed and the indices of energy, carbohydrates and non-starch polysaccharide (NSP) were estimated.

The nutrient indices were analyzed by applying simple equations, which were illustrated as follow[45-46]:

- Energy contents index formula:

$$EI = \frac{AEC}{ARE} \times 100 \quad (1)$$

Where:
EI = Energy index
AEC = Average energy content
ARE = Average recommended energy

- Simple sugar contents index formula:

$$SSI = \frac{ASSC}{ARSS} \times 100 \quad (2)$$

Where:
SSI = Simple sugar index
ASSC = Average simple sugar content
ARSS = Average recommended simple sugar

- Non-starch polysaccharides index formula:

$$NSPsI = \frac{ANSPsC}{ARNSPs} \times 100 \quad (3)$$

Where:
NSPsI = Non-starch polysaccharides index
ANSPsC = Average non-starch polysaccharides content
ARNSPs = Average recommended non-starch polysaccharides

Analytical technique of data analysis: The data was analyzed using Statistical Package for Social Sciences (SPSS for Windows, Version 21.0). All data were examined using two-tailed with a significant level of $p < 0.05$ and were checked for normality using the Shapiro-Wilk test. Results were expressed as percentage (%) and Mean±SE. The differences between male and female, non-diabetic and diabetic individuals and city population and villagers were analyzed by using one way ANOVA test. Both Pearson and Kendall's correlations were used to test the relationship between age, BMI, T2DM and the consumption of dates.

RESULTS

The results had revealed that the average age of participants was 35.09±0.29 and they were slightly overweight with BMI 25.95±0.12 (Table 1). However, diabetic individuals were significantly older and had higher BMI in comparison to non-diabetic participants ($p<0.001$).

The prevalence of T2DM among participants was 7% (Fig. 1). Moreover, Table 1 demonstrated that there was a difference in the consumption of dates in favor of diabetic participants. This difference was significantly high ($p< 0.05$) in terms of the nutrient indices for energy, simple sugars and NSPs (Table 1).

In this study the total consumption of dates (Both Rutab and Tamer) reached approximately 100±2.31 g per day and it was higher in male vs. female, diabetics vs. non-diabetics and villagers vs. city population (Fig. 2).

The results had also shown that the consumed dates could secure approximately 11, 16 and 24% of daily intake of energy, simple sugars and non-starch polysaccharides (NSPs), respectively. These nutrient indices were significantly lower ($p<0.05$) for consumed Rutab compared to consumed Tamer (Fig. 3).

Table 1: Comparison between non- diabetic (n = 2027) and diabetic (n = 150) participants

Variable	Non-diabetics	Diabetics	Total	p-value
Age (year)	34.0±0.29	49.7±1.10	35.0±0.29	0.000
Weight (kg)	69.5±0.37	76.6±1.30	69.9±0.36	0.000
Height (cm)	164.0±0.20	163.4±0.82	164.0±0.19	0.386
BMI (kg m^{-2})	25.7±0.12	28.7±0.47	25.95±0.12	0.000
Dates consumption (g $days^{-1}$)	99.7±2.30	113.5±12.87	100.6±2.32	0.130
Energy (%)	11.4±0.25	13.7±1.58	11.6±0.26	0.026
Simple sugar (%)	16.0±0.35	19.2±2.22	16.2±0.36	0.026
NSPs (%)	23.8±0.53	28.4±3.17	24.1±0.54	0.032

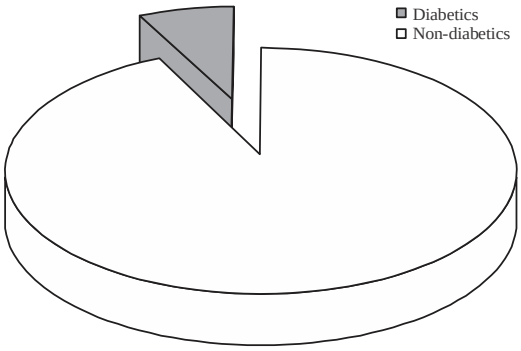

Fig. 1: Prevalence of type 2 diabetes among participants

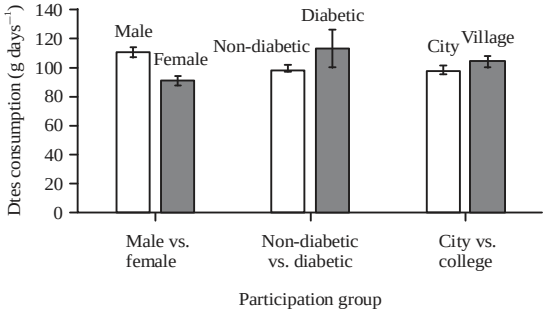

Fig. 2: Consumption of dates by different groups

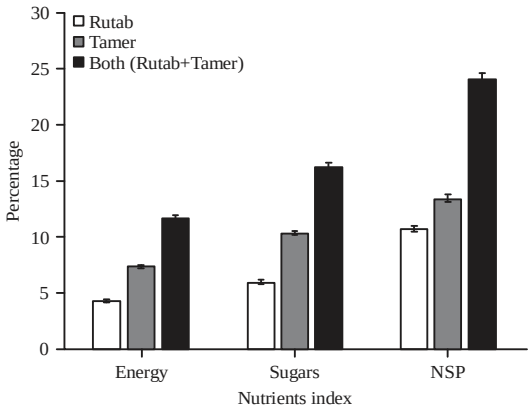

Fig. 3: Nutrient indices between date consumer participants of Rutab, Tamer and both

DISCUSSION

The main objective of present study was to estimate the consumption of dates and its association with prevalence of T2DM. The average daily consumption of dates in this study was quite similar to that reported in 2003[42]. In fact, the highest consumption of dates was found among Arab Gulf populations[42-44,47]. However, the daily date intakes in these countries[47] vary from 68-164 g. It should be considered that our study estimated only the dates consumed as fresh or dried without considering the dates in other products or date-based-products. The consumption of dates as date-based products by Saudis represented[42] about 22%. Thus, the average consumption of dates and dates products would be 122 g per day in Saudi Arabia. Similarly, it has been found that the daily consumption of dates by UAE citizens ranged[43,44] from 72 g to 114 g. Moreover, another study concurred the fact that males consumed higher amount of dates in comparison to females[43].

Indeed, dates are considered as a high source of energy due to the presence of readily digested and absorbed carbohydrates, mainly glucose and fructose[48]. The presence of these natural sugars can be a good source of instant energy for the human body. Moreover, the presence of high fructose in dates makes it ideal to be incorporated into a diabetic's diet on the daily basis, as fructose is less diabetogenic than glucose[49]. On the other hand, high fructose fruits can cause serious health complications in people with a history of heredity fructose intolerance[50]. However, this study found that the consumption of dates covered only about tenth of the energy requirement. In contrast, the dates consumption secured about the 4th of the recommended daily intake of NSPs. This finding is interesting but it is quite lower than that has been mentioned, where consuming 100 g of dates may provide about third of the requirement[48] of NSPs. NSPs have received an interest for their physiological benefits. Interestingly, this study found that the consumption of dates by diabetic participants was higher than that seen in non-diabetics. Diabetic patients can benefit from the high NSPs content of dates. In fact, dates contain a high level of dietary NSPs[4-5]. It is well documented that high intake of dietary NSPs is associated with a lower risk of developing T2DM[51]. Furthermore, high NSP diets have beneficial effects in improving insulin sensitivity and therefore reducing the risk of developing T2DM[11,23,26,52-53].

Current results also had shown that the consumption of Rutab was lower than the consumption of Tamer. In contrast, Ismail *et al.*[44] found that the Rutab was more frequently consumed than Tamer during the summer season among UAE citizens.

It is fact that T2DM is strongly associated with obesity and an inactive lifestyle[33]. This study found that diabetic participants had significant higher BMI in comparison to non-diabetic individuals. Moreover, there was no association between the dates consumption and diabetes. It has mentioned that the consumption of dates has not shown to be associated with metabolic syndrome and related diseases[10].

CONCLUSION

One of the major concerns among the public is whether the regular consumption of dates increases the risk of diabetes. This study assumed that dates may be included as part of a diabetic's diet on a daily basis and diabetic individuals can benefit from the high fibre content present in dates. Further long-term clinical trials are recommended to help researchers understand the effect of dates intake on blood and insulin levels in individuals with type 2 diabetes mellitus. Thus, a new theory on the impact of dates consumption on diabetic control may be developed.

SIGNIFICANCE STATEMENT

The study discovered that there is no association between date consumption and the prevalence of type 2 diabetes. Moreover, diabetic individuals can benefit from the high fibre content present in dates. Further clinical trials are recommended to help researchers to understand the effect of date intake on blood profiles in individuals with type 2 diabetes mellitus that some investigators have tried to explore. Thus, a new theory on the impact of dates consumption on diabetic control may be developed.

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