



Biochemical Study of Consumption Zahdi Dates (*Phoenix dactylifera*) in Type 2 Diabetic Patients

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ABSTRACT

Dates considered one of most significant commercial crops and have been documented in the Holy Quran and scientific references. This study was designed to determine the therapeutic effects of Zahdi variety of dates in control subjects and their effects on glucose, cholesterol, triglyceride (TG), malondialdehyde (MDA), glutathione (GSH), antioxidant vitamins (C and E), and inorganic phosphate and calcium excursions. Study subjected twenty-four control group (12 male and 12 females), mean age (42.0 ± 8.69 year), and twenty patients with diabetic type 2 (10 males and 10 females) with a means of HbA1c (9.25 ± 2.02 %) and age (47.7 ± 9.33 year). All participants ate a single number of the Zahdi dates (5-7) before breakfasting for a prior twenty-one days. Glucose was measured in control group and for diabetics.

Glycemic index (GI) was established as proportion of the gradational areas below the return curves for dates as compared to glucose. Collecting blood samples from patients and control group were collected and the statistical data examinations are achievement by using independent samples and paired t-test. The results indicated a significant increase in glucose, MDA, total cholesterol and TG, while a significant decrease in GSH, vitamins (C and E) and phosphate in patients when compared with control group (previously and in accordance) consumption dates palm. No considerable changes in calcium level between diabetic and control subjects. The consumption of dates palm led to a significant decrease in MDA, total cholesterol, TG, and phosphate, also a significant increase in GSH and vitamin E in diabetic patients when compared with control group.

Keywords: Diabetic mellitus, Zahdi Dates, Triglycerides, Malondialdehyde, HbA1c.

INTRODUCTION

The dates palm fruits (DPFs) are the oldest cultivated trees, and its fruits possess a substantial number of nutriment and practicable constituents. It is an important plantation crop for many countries extending from North Africa to the Middle East including many states of the Arabian Gulf countries especially in Iraq (Trabzuni *et al.*, 2014). Date palm is ultimate important and successful substance output in greatest of the hot barren desert district. Generally, whole dates are harvested and marketed at three stages of development: mature firm (Khalal), full ripe (Rutab) and dry (Tامر). The decision for harvesting at one or other stage depends on cultivar properties, especially soluble tannins levels, climatic conditions and market demand. Dates may be considered as an ideal food to thrift expanse range of fundamental nutrients and potential health benefits (Al-Gorany *et al.*, 2020). They are a concentrated source of essential nutrients, a lot of supplements and minerals, fiber, and carbohydrates which are requisite for the maintenance of optimum health and has been estimate by the glycemic index (GI), which has indicated that most date varieties have low GI values. This finding confirms the minimal effect of both the goodness and amount of DPF carbohydrates. GI in DPFs is a better indicator to estimate the overall impact of carbohydrates on serum glucose response (Al-Mssallem, 2020). A lot of the carbohydrates in dates come from sugars including monosaccharaides (Hossain, 2015; Mohammed, 2016). The (*Phoenix dactylifera L.*) is a beneficial traditional medicinal plant belonging to *Arecaceae* family (Sirisena *et al.*, 2015). The genus *Phoenix* comprises 14 species including *P. dactylifera* that have been planted in Middle East (Copley *et al.*, 2001).

The *P. dactylifera* produces are broadly used daily food in Islamic countries, this is shown through its history from more than 1400 years. In the month of Ramadan, they are usually breaking their long day fasting with dates (Baliga *et al.*, 2011). Ajwa dates, a special class of date extant in Arab countries, have been declared by the Prophet (peace be upon him) as he said, "If Somebody consumed seven Ajwa dates in the morning, neither magic nor poison will harm him that day". In addition, the Prophet mentioned the avail of dates from Medina Al-Monawara, said, "He who ate seven dates (of land situated) between these two lava plains in morning, no toxin will damage him until it is evening" (Siddiqui, 2009). All *P. dactylifera* produces such as fruits, seeds, pollen, leaves, and syrup have useful uses (Yaseen *et al.*, 2019). Previous studies demonstrated that the date and seeds contain many chemical substances such as anthocyanins, phenolics, sterols, carotenoids, flavonoids, procyanidins, and compounds, anti-mutagenic, antimicrobial properties, anti-inflammatory, anti-hyperlipidemic, gastroprotective, hepatoprotective, nephroprotective, anticancer, immunostimulant activities and reduces intestinal pain (El-Far *et al.*, 2016).

Oxidative stress is an imbalance between oxidant production and enzymatic and non-enzymatic (Yaseen *et al.*, 2020). The *P. dactylifera* has antioxidant components by phenolic acids, flavonoids, polyphenols and small molecules like vitamin C, vitamin E and glutathione. The free radical and attached reactive species possible bring about oxidative stress, which generate extensive interdependence differences of cellular metabolism, rises serum marker enzymes, DNA fragmentation, and lipid peroxidation (Al-Zeiny and Abbas, 2017).

Furthermore, the fruit of dates were shown to have potent antioxidant activity, because they inhibit *in vitro* lipid peroxidation, oxidation of protein and free radical scavenging capacity possess (Saada *et al.*, 2012).

Diabetes Mellitus (DM) is a metabolic syndrome due to poor blood glucose control, and one of a popular chronic disease affecting many people internationally (Cassiano *et al.*, 2020). It lasts to increase both in numbers and in influence upon fineness of natural life, as changing way of life result in reduced physical activity and augmented obesity (Al-Dulaimi *et al.*, 2019). The complications of diabetes are concerning to oxidative stress incite by hyperglycemia, it is reducing the body natural antioxidant system (Sk and Jayant, 2018). The hemoglobin A1c (HbA1c) examination supply a responsible measure of chronic glycaemia and get together well with the

hazard of long-range diabetes complications, so it was actually considered the check of choice for observing and management of DM (Thiyam *et al.*, 2017).

This study aims to examine of consuming palm of date in regulation blood glucose concentrations in patients with diabetes mellitus type 2. Indeed, DPF components may be share to diabetes therapy and delay the expansion of diabetes-related complications, though it is included elevated amount of sugar.

MATERIAL AND METHODS

Study was planned on number of contributors in Baqubah city, Diyala province, Medical Laboratory Technology Department, Technical Institute of Baqubah. Volunteers ate a single number of Zahdi dates (5-7) before breakfasting for a prior twenty-one days. This type is distinctive by very good qualities, the greatest is presence sugar amounts. As well the Zahdi dates has been characterize semi-dry varieties, non-sticky, long storage periods. In the wake of giving educated composed assent, all contributors finished a questioner-controlled poll coverture demographic details, smoking and alcohol drinks, previous therapeutic, surgical history, co-morbidity diseases, pharmaceutical apply and presently health case. Knowledge on illness commencement, duration, administration has been elicited in diabetes patients. Samples succumbed to whole physical check involving tallness, weighing, body mass index (BMI). Connotation criterions demanded those in healthy collection have been actually healthy also, in diabetes collection that diabetes has been dominated ($HbA1c \leq 8\%$) on dietary with metformin or without it. Exception principle for control and diabetic samples contained ghastly corpulence ($BMI \geq 30 \text{ kg/m}^2$), pre diabetes, gravid, smoking, alcohol drink, existence of gastroenterological maladies, dietary tract surgery, taking pharmaceutical (except metformin).

Study samples have been twenty four healthy control volunteers (12 males and 12 females), (Mean \pm SD) age equal (42.0 ± 8.69) years and twenty contributors of diabetes mellitus type 2 (10 males and 10 females, under control on way of life estimates and/or metformin) with mean of HbA1c (\pm SD) equal ($9.25 \pm 2.02 \%$) and mean age (47.7 ± 9.33) years. They recorded for the monograph (Table 1). Subjects have been informed of the owing study and their approval was acquired. Non-diabetic volunteers were adjudged to be in good health as stated in as stated in their fasting serum glucose level ($<120 \text{ mg/dl}$).

Ten milliliters of venous blood were taken from all subject and left for (15) minutes at 37°C , then the serum was be centrifuge at $3000 \times g$ and divided for further biochemical tests (Tietz *et al.*, 2006).

CHEMICAL AND REAGENTS

All chemical compounds and reagents were of annular grade, from Fluka, BDH, Sigma and Aldrich. Kits for the assay of Glucose, total cholesterol (TC) and Triglyceride (TG) were processing it from Human GmbH (65205 Wiesbaden, Germany), Whereas Kits for the assay of Calcium and phosphorous have been bought from AGAPPE DIAGNOSTICS SWITZERLAND GmbH, and kits of HbA1c from boditech company by CHROMA II instrument.

BIOCHEMICAL ASSAYS

The HbA1c was assay by using sandwich immune detection method by ichroma instrument (Goldstein *et al.*, 1995).

Determination of glucose was executed by enzymatic oxidase-peroxidase method according to (Tietz *et al.*, 2006) as modified by Randox Laboratories, United Kingdom. Catalog number; GL 1021, GL 304, GL366.

The serum lipid peroxide was tested by precipitating lipoproteins with trichloroacetic acid and boiling with thiobarbituric acid which reacts with MDA to get pink color as process of (Wysocka *et al.*, 1995).

A modified method was using to estimated reduced glutathione by researchers (Sedlak and Lindsay, 1968), and the method depends on the use of Ellman's reagent which is containing 5,5-dithio bis 2-Nitrobenzoic acid (DTNB).

Ascorbic acid can be determined by photometrically with 2,4-dinitro phenylhydrazin to form the red bis-hydrazone (Colowick and Kaplan, 1979).

The chemical methods for determination of vitamin E are based on an oxidation reduction reaction following Emmerie-Engel procedure (Harold *et al.*, 1976).

Total cholesterol assay kit by colorimetric method (Tietz *et al.*, 2006) as modified by Randox Laboratories, United Kingdom. Catalog number; STA-384, 192 assays.

The quantitative enzymatic measurement of glycerol, was used to determined serum true triglycerides, and total triglycerides in serum at 540 nm (Tietz *et al.*, 2006) as modified by Randox Laboratories, United Kingdom. Catalog number; STA-396, 100 assays.

Inorganic phosphorous level was assay by using phosphomolybdate methodology (Tietz *et al.*, 2006).

The colorimetric calcium method was used to examine the calcium concentration according to (Gindler and King, 1972).

STATISTICAL ANALYSIS

The data presented in this investigation has been disclosed as means \pm standard deviation (SD) and comparison between patients and control group was made by using student's independent t-test the probability value ($P < 0.05$) was considered significant. Statistical analyses have been accomplished using the Mann-Whitney U exam and reduplicate assess analysis of differences (Hinton, 2004).

RESULTS AND DISCUSSIONS

The research has been planned to exam glycemic indices of Zahdi dates of control group and its influence of glucose concentration in diabetic patients. Results have been observed different parameters which include age, body weight, height, body mass index and HbA1c in control and patients with DM, (Table 1).

Table (1) indicate that there were 24 healthy subjects as control group (12 males and 12 females) at mean (\pm SD) of age (42.0 ± 8.69 years). The BMI equal (28.3 ± 3.81 kg/m²), the mean HbA1c is ($5.65 \pm 0.34\%$). And 20 patients of diabetes type 2 (M:F = 1to1). The (Mean \pm SD) of age is (47.7 ± 9.33 years), BMI (\pm SD) of (26.33 ± 3.34 kg/m²) and mean HbA1c (\pm SD) is ($9.25 \pm 2.02\%$).

Table 1: Demographic and characteristics of other baseline on the studied samples

Parameter (Mean \pm SD)	Control group (n = 24)	DM of type 2 group (n =20)
Age (Years)	42.0 \pm 8.69	47.7 \pm 9.33
Body weight (Kg)	88.9 \pm 12.99	73.5 \pm 14.58
Height (cm)	177.5 \pm 14.09	166.5 \pm 10.37
Body mass index (Kg/m ²)	28.3 \pm 3.81	26.33 \pm 3.34
HbA1c (%)	5.65 \pm 0.34	9.25 \pm 2.02

Table (2) shows statistically changes in glucose concentration of control group and patients with diabetic's groups before and after eating dates. The calculated (Mean \pm SD) of the dates between control group have been (92.71 ± 22.7 , 81.76 ± 22.98 mg/dl) respectively, and the glucose level of diabetic patients type 2 before and after eating dates were (237.67 ± 55.17 , 201.33 ± 59.98 mg\dl) respectively.

Results were corresponding with (Mohammed, 2016). The dates included rising amounts of sugar. So, it's unusual to lead to hypoglycemia. But if in case that happens, one should consider a rare condition i.e., hereditary fructose intolerance. These data indicates to the potential support of dates for diabetic patients as it was applied in a healthy balanced diet. Dates are wealthy in nutrients and are largely consumed in some regions, especially Islamic world. They referred to in the Qur'an and in Hadith (sayings of the Holy Prophet Mohammed peace be upon him). Our studied of Zahdi dates are rich in reducing monosaccharaides. The carbohydrate in dates be based on type of date, degree of ripeness and highest concentration at tamer grade (Alkaabi *et al.*, 2011).

Table 2: The glucose in serum of diabetic patients and control group.

Groups	Parameters (Mean ± SD)
	Glucose mg/dl
Control before eating dates	92.71±22.70
Patients before eating dates	237.67±55.17 **
Control after eating dates	81.76±12.98
Patients after eating dates	201.33±49.98 **

**The difference between patients and control group at $P < 0.01$

As well the results show no significantly decreased in control group themselves before and after eating dates, nor than patients' groups themselves as in (Table 2). While other studies note the low glucose of dates can be refer to their high fructose and dietary fiber content (Al-Farsi and Lee, 2008).

The target of study was to estimate the influence of date palm to free radical products after dates consumption. The mean MDA concentration before and after eating dates for control group were $(1.23 \pm 0.19, 0.90 \pm 0.09 \mu\text{mol/L})$ and patients were $(2.35 \pm 0.42, 1.88 \pm 0.27 \mu\text{mol/L})$. Results indicated that there were significant changes in levels of MDA between control and diabetics group before and after eating dates. Higher level of MDA was noted in type 2 diabetics when comparative with the control group. A biomarker of lipid peroxidation (MDA) and oxidative stress metabolic disturbances contributes to oxidative stress which results from an imponderable among oxidants and antioxidant defend system (Fumiaki *et al.*, 2019). Diabetics undergo oxidative stress as results on prolonged exposure to hyperglycemia which causes tissue damage through excess the intracellular formation, activation protein kinase C isoforms, polyol pathway, glucose oxidation and over activity of hexosamine pathway. The formed free radicals impair membrane function in patients by decreasing membrane fluidity (Edward *et al.*, 2019; Khushbu *et al.*, 2019). Also, the results fixed that the eating dates palm reduce the levels of MDA in the two groups. Present investigation has been corresponding about the various authors in their studies like (Saryono *et al.*, 2017) who have all shown the significant higher of MDA in diabetes as compared to control group.

Significant reduction in glutathione content were observed in diabetic patients before and after consumption dates fruit which were $(6.73 \pm 0.09, 7.53 \pm 0.16 \mu\text{mol/L})$ in comparison to control group $(7.85 \pm 0.12, 8.97 \pm 0.19 \mu\text{mol/L})$ before and after eating dates palm as shown in (Table 3).

Table 3: The MDA and glutathione concentration in serum of diabetic patients and control group

Groups	MDA ($\mu\text{mol/L}$)	Glutathione ($\mu\text{mol/L}$)
	(Mean± SD)	
Control before eating dates	1.23±0.19	7.85±0.12
Patients before eating dates	2.35±0.42**	6.73±0.09*
Control after eating dates	0.90±0.09	8.97±0.19

Patients after eating dates	1.88±0.27**	7.53±0.16*
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* The differences between patients and control group at P<0.05

** The differences between patients and control group at P<0.01

Decreased concentration of glutathione indicates decreased scavenging capacity of glutathione-dependent anti-oxidant defensive system against elevated lipid peroxidation processes in these patients. Antioxidant enzyme-dependent defenses perform a create role in scavenger free radicals produced oxidative stress (Ibrahim *et al.*, 2017).

Also, the results in (Table 3) noted that the eating of palm led to raise the GSH in control and patients' groups, these results were agreement with (Ibrahim *et al.*, 2017) which they observed that the new natural flavonoid compounds isolated from the acetone extract of date fruits epicarp belonging to family *Arecaceae (Palmae)*. These compounds were assessed for their biological activity on alloxan diabetic rats. Doses of 1.5 ml suspensions/100 gm. body weight. were orally administrated to alloxan diabetic rats for 30 days. The treatment of diabetic rats with these compounds resulted in obvious betterment of the various biochemical results (Helana *et al.*, 2012).

A significantly decreased at (P < 0.01) in vitamin C concentration in serum of patients with diabetic mellitus before and after consumption dates palm which were (14.15±1.21, 17.97±0.69 µmol/L) respectively, comparison with control group before and after consumption dates palm (26.55±0.78, 27.24±0.79 µmol/L) respectively as in (Table 4). The result is convention with former statements which that noted a significantly decreased vitamin C in diabetic mellitus type 2 patients (Wilson *et al.*, 2017; Edward *et al.*, 2019).

Table 4: The vitamin C and vitamin E concentration in serum of diabetic patients and control group

Groups	Vit C (µmol/L)	Vit E (µmol/L)
	(Mean±SD)	
Control before eating dates	26.55±0.78	15.38±0.89
Patients before eating dates	14.15±1.21 **	6.87±0.65 **
Control after eating dates	27.24±0.79	22.86±1.75 #
Patients after eating dates	17.97±0.69 **	10.89±0.99 ***

** The differences between patients and control group at P<0.01

The differences between patient's group themselves and between control group themselves at P<0.05

The current project observed decrease level of vitamin C in diabetics when compare with control group. The vitamin C is water soluble dietary antioxidant which is obtained exogenously in natural and synthetic form. It was behaving as a reducing agent in free radical-mediated oxidation process. Deficiency found in diabetes probably because insufficient intake and also competition of ascorbic acid with glucose due to structural similarity for uptake into cells (Edward *et al.*, 2019). Hyperglycemia delays vitamin C absorption and metabolism which may increases cellular uptake and turnover for biological functions which led to deficiency. Deficiency of vitamin C in diabetes involved defective formation of collagen and connective tissue in the skin, cartilage dentine, bone, blood vessels and interfere with vasodilation and endothelial function of blood vessels. Also, low level found may be because the increased oxidative stress that depletes this antioxidant in metabolic process that increases glucose dependent inhibition of enhanced erythrocyte fragility that potentially contributes to complications of type 2 diabetes (Wilson *et al.*, 2017).

The result in (Table 4) point out that there are no significantly changes between the patients and control group themselves. The same results notice the vitamin C concentration was not significantly altered by date seeds (Hosam and Wissam, 2011).

The lower level of tocopherol as vitamin E observed in diabetes when compared about control group may be because inadequate compensatory antioxidant defense in oxidative stress intracellular pathway vitamin E has been main lipid-soluble, chain breaking lipid peroxy scavenging antioxidant which protects polyunsaturated fatty acid and component of cell membrane, low density hypo protein from oxidation. Lack vitamin E in diabetes is because of glucose and lipid metabolism dysfunction that affect absorption and metabolism which impair activity of antioxidant. Also, insufficient intake affects immune function, cell signaling regulation of gene expression, inhibitory effect of smooth muscle proliferation, platelet adhesion which product in micro vascular and macro vascular complication in type 2 diabetes. Also, deficiency can affect modulatory properties which may result in neuromuscular problems such as loss of vibration sensation and permanent nerve damage in diabetes patients (Edward *et al.*, 2019).

Vitamin E is an antioxidant which development the chronic diseases such as cancer, complications in DM (Pavithra *et al.*, 2018). The study showed that date palm can increase vitamin E levels in control and DM groups significantly at ($P < 0.05$), and it were agreement wit (Saryono *et al.*, 2017).

Table (5) show the results of total cholesterol in control and diabetic patients' groups before and after eating dates and indicated that there were a significantly increase at ($P < 0.05$) in patients' group ($6.94 \pm 0.84 \text{ mmol/L}$) when compared with control group before eating dates ($4.20 \pm 0.48 \text{ mmol/L}$). These results agreement with (Paul and Paul, 2013) which they show a link between insulin resistance, which is a precursor to type 2 diabetes, and diabetic dyslipidemia, atherosclerosis and blood vessel disease. These conditions can develop even before diabetes is diagnosed. The same (Table 5) indicated the results of patients group ($5.32 \pm 0.41 \text{ mmol/L}$) compares with control group after consumption dates fruits ($3.84 \pm 0.33 \text{ mmol/L}$).

When compared between control and patients group themselves before and after consumption dates, we observed low serum cholesterol level in control and in DM patients after eating dates when compared with the two groups before eating dates. These results were conformable with (Rock *et al.*, 2009, Saada *et al.*, 2012), in which they showed the dates as an antihyperlipidemic activity. Studies showed that feeding rats with diet containing defatted date seed flour at 1.5%, 2.5% and at 5.2% concentration caused decreasing in plasma triglycerides, total cholesterol and low-density lipoprotein (Rock *et al.*, 2009) investigated that after 4weeks Medjool or Hallawi dates consumption, the VLDL-cholesterol levels tended to be decreased (by 8 or 15%, respectively. Besides in human, the dietary fiber feeding reduces blood cholesterol concentration. The findings of these studies suggested that nutrition based on date seed fiber had a good source of fiber. Date Plant leaves extracts could have a preventive effect versus hyperlipidemia through improvement of lipid profile. The fat component of date skin plays a potential protective role for the date contents (Eimaddine *et al.*, 2020).

Table 5: The cholesterol and triglyceride concentration in serum of diabetic patients and control group

Groups	Cholesterol (mmol/L)	Triglyceride (mmol/L)
	(Mean±SD)	
Control before eating dates	4.20 ± 0.48	2.87 ± 0.22
Patients before eating dates	6.94 ± 0.84 *	5.35 ± 0.69 **
Control after eating dates	3.84 ± 0.33	0.67 ± 0.09 ##
Patients after eating dates	5.32 ± 0.41 *	2.48 ± 0.24 ** ##

* The differences between patients and control group at $P < 0.05$

** The differences between patients and control group at $P < 0.01$

The differences between patient's group themselves and between control group themselves at $P < 0.01$

Table (5) reveals there was a significantly increased ($P < 0.01$) in triglyceride concentration of patients before and after consumption dates (5.35 ± 0.69 , 2.48 ± 0.24 vs 2.87 ± 0.22 , 0.67 ± 0.09 mmol/L). This result is in agreement with previous reports as (Kenzo *et al.*, 2005; Thiyam *et al.*, 2017).

The main quantitative abnormalities of lipids in diabetes are increased triglyceride (TG) levels. The main qualitative abnormalities include large VLDL particles, relatively rich in TG, small dense LDL particles, increase in TG content of LDL and HDL, glycation of apolipoproteins and increased susceptibility of LDL to oxidation. LDL particles are small and dense in type 2 diabetes and are susceptible to oxidation (Kenzo *et al.*, 2005).

The reduction in triglycerides concentration after consumption dates may be due to bile acids. Therefore, this inhibition of absorption of dietary fat. The cholesterol in date fruits have potential to domination the risk of atherosclerosis data suggested development in humans (Al-Humaid *et al.*, 2010).

Results in (Table 6) show the phosphorus concentrations in serum of control and in diabetics patients before and after eating dates, which elucidate no significant changes between two groups before eating dates. But there was a significantly decreased at ($P < 0.05$) in patients with diabetic type 2 when compared with control group after eating dates which was (10.48 ± 1.65 , 7.43 ± 1.05 mg/dl) respectively. When compared between control and patient's group themselves before and after eating dates, we note that there were a significantly increased in phosphorus concentration before and after eating dates at ($P < 0.01$).

Table 6: The phosphorus and calcium concentration in serum of diabetic patients and control group

Groups	Phosphorus (mg/dl)	Calcium (mg/dl)
	(Mean \pm SD)	
Control before eating dates	2.80 \pm 1.41	9.35 \pm 0.07
Patients before eating dates	2.71 \pm 0.62	9.23 \pm 0.64
Control after eating dates	10.48 \pm 1.60 ##	9.32 \pm 0.29
Patients after eating dates	7.43 \pm 1.05* ##	9.22 \pm 0.24

* The differences between patients and control group at $P < 0.05$

The differences between patient's groups themselves and between control group themselves at $P < 0.01$

Levels of serum phosphorus were lower in diabetics in comparison to control group after eating dates may indicate a possible negative effect of hyperglycemia on serum phosphorus. Also, low phosphate levels were known to affect those who have type 2 diabetes especially those treated with insulin because insulin has been reported of influence the phosphorus excretion by renal tubules (Nasir *et al.*, 2013). The results were agreement with (Zhong *et al.*, 2016) which they note that the serum level of phosphate in type 2 diabetic group was significantly lower than that in the control group at ($P < 0.05$).

The full nutrition content, Recommended Dietary Allowance (RDA) percentages and levels for dates, should be considered along with the phosphorus content (62 mg of phosphorus per 100g), from dates, corresponds to 6% of the phosphorus RDA. For a typical serving size of 1 date, pitted or (24gm) the amount of phosphorus is (14.88mg). The high concentration of phosphorus in control and patients' groups plays an important role in how the body uses carbohydrates and fats. It is necessary for the body to make protein for growth, maintenance, and repair of cells in tissues.

Phosphorus also helps the body make ATP, a molecule the body uses to store energy (Hina *et al.*, 2018).

Table (6) show the results of calcium concentration in serum blood of control and diabetic patient's groups before and after consumption dates fruits and indicate that there were no significant changes between patients group compared with control group, nor between the groups themselves. The results were matching with (Zhong *et al.*, 2016) which they show that there was no significant difference in the level of serum calcium between the two groups.

CONCLUSION

The outcome discerns those glycemic indices has been dropped in dates palm fruits (DPFs) and their consuming five to seven dates by patients with diabetic into their diets on a daily basis not gave a significant postprandial glucose trek. These data refer to the interest dates of diabetic at using in a balanced diet. Also, date palm shown to reduce levels of MDA and increase vitamin E in treatment group. Its mean that date palm may be believed promising source of new natural antioxidant agent to decrease MDA levels. These dates might be useful for common people. This study will assist researcher to scout about date palm further studies on the impacts of long-dated administration on organs of the body. Thus, it is safe for consumption. It may be recommended that it may be remarkable diet for the diabetic patient due to lowering of overall sugar content when comparison with fresh fruit having higher sugar content.

CONFLICT OF INTERESTS

The authors have declared no conflict of interests.

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دراسة كيموحيوية لاستهلاك تمر الزهدي (*Phoenix dactylifera*) عند مرضى السكري من النوع الثاني

الملخص

تعد التمور من أهم المحاصيل التجارية وقد تم ذكرها في القرآن الكريم والمراجع العلمية. صُممت هذه الدراسة لتقدير الآثار العلاجية لأنواع تمر الزهدي لدى الأشخاص الاصحاء وتأثيرها على الكلوکوز والكوليسترول الكلي وثلاثي الكليسرأيد (TG) والمالوندايديهايد (MDA) والكوتاتايون (GSH) والفيتامينات المضادة للاكسدة (E و C) والفوسفيت اللاعضوي والكالسيوم. شملت الدراسة أربعة وعشرين فردًا سليمًا (12 ذكر و12 أنثى)، متوسط العمر (8.69 ± 42.0 عامًا)، وعشرين مريضًا مصابًا بمرض السكري من النوع 2 (10 ذكور و10 إناث) بمستوى هيموكلوبين سكري (2.02 ± 9.25 %) وعمر (9.33 ± 47.7 سنة). جميع المشاركين تناولوا عددًا مفردًا من تمر الزهدي (5-7) قبل الإفطار لمدة واحد وعشرين يومًا. تم قياس الكلوکوز في الأشخاص الأصحاء ولمرضى السكر.

تم تحديد مؤشرات الجهد السكري في الدم كنسب للمساحات المتزايدة تحت منحنيات الاستجابة للتمر مقارنة بالكلوکوز. اذ جمعت عينات الدم من المرضى ومجموعة السيطرة واجري التحليل الإحصائي باستخدام اختبار t. أشارت النتائج إلى زيادة معنوية في تركيز الكلوکوز، MDA، الكوليسترول الكلي و G، مع انخفاضًا معنويًا في تركيز GSH والفيتامينات (E و C) وتركيز الفوسفيت لدى المرضى مقارنة بمجموعة السيطرة (قبل وبعد) استهلاك التمور. لم تكن هناك تغييرات كبيرة في مستوى الكالسيوم بين مرضى السكري والأصحاء. أدى استهلاك التمور إلى انخفاضًا معنويًا في كل من MDA، والكوليسترول الكلي، و TG، والفوسفيت، كما ظهر أن هناك زيادة معنوية في تركيز GSH و فيتامين E لدى مرضى السكري على النقيض من مجموعة السيطرة.

الكلمات الدالة: داء السكري، تمر الزهدي، ثلاثي الكليسرأيد، المالوندايديهايد، الهيموكلوبين السكري.