

Nutritional and Medicinal Value of Mineral Elements in Dates

Mahmoud M. Abo-El-Saad¹ and Samar M.S. Shawir²

ABSTRACT

Dates are a nutritionally rich food that contains at least 15 different minerals, such as magnesium, manganese, phosphorus, iron, calcium, potassium, sodium, and zinc. Studies conducted by Agoudjil et al. in 2011 and Ayad et al. in 2016 have found that the mineral content in dried dates ranges from 0.1 to 916 mg per 100 g of date flesh. Dates are rich in copper, selenium, potassium, and magnesium, and have modest amounts of manganese, iron, phosphorus, cobalt, fluorine, zinc, calcium, and chromium. They also contain small quantities of boron (Agoudjil et al. 2011). Chromium has been found to play an essential role for type 2 diabetics, as it increases the binding of insulin to its receptors on the cell surface and thus allows the passage of sugar to be used in vital processes instead of being excreted in the urine. The flesh of several date varieties can have a potassium concentration as high as 0.9%, while the seeds can have 0.5%. Date flesh is primarily composed of potassium, with a reduced phosphorus level compared to other macro-elements (Assirey 2015). Some trace elements, including zinc and copper, have been identified in low concentrations in dates, while iron is found in higher concentrations (Assirey 2015). Research has shown that the abundant potassium present in dates can be advantageous for those with hypertension. Boron is quite beneficial in the treatment of brain cancer, as well as other vitamins, and is also employed in the treatment of rheumatism (Vayalil 2012). The high concentration of fluorine present in dates is advantageous in the prevention of dental caries. Additionally, the presence of selenium in dates can aid in the prevention of cancer and enhance the human immune system. Based on a prior investigation, several types of dates contain selenium levels ranging from 1.48 to 2.96 µg/g (Vayalil 2012). Dates can serve as a dietary source of iron to address iron deficiency, without the potential adverse effects of standard iron supplements, such as nausea, headaches, and lack of appetite. Dates are a nutrient-rich choice when compared to other dried fruits, according to the US Department of Agriculture (USDA, 2011). Furthermore, fresh dates possess elevated levels of vitamins compared to dried dates due to the loss of vitamins during the drying procedure. Dried dates include thiamine, riboflavin, niacin, ascorbic acid, pyridoxine, and vitamin A, but in relatively low amounts (Hassan et al 2017).

Keywords: Dates, mineral elements, nutritional values, medicinal benefits, insulin receptor.

INTRODUCTION

The date palm is indigenous to dry environments. The cultivation of the date palm is primarily concentrated in arid regions of Africa, the Middle East, and specific portions of Asia. Moreover, it has been introduced in North America and Australia.

The palm tree usually begins bearing fruit when it reaches four or five years of age, but it will not reach maturity in production until the age of 10 to 12 years. Many palm trees live to be 100 years old. Some even reach 150 years. Dates are highly regarded as a crucial and essential source of nourishment for human health and overall well-being, thanks to their remarkable nutritional and therapeutic properties. Dates are sometimes referred to as "mineral mines" due to their high content of essential mineral elements, making them a valuable source of nutrition. Dates are rich in minerals and vitamins. Dates exhibit a high concentration of iron, potassium, calcium, magnesium, and moderate levels of chloride, phosphorus, copper, magnesium, sulfur, and silicon, with minor quantities of sodium. It

contains vitamins and is rich in the minerals as well as fiber and protein. Dates do not contain fat or cholesterol, but they are high in carbohydrates. Dates are generally considered low in calories. Approximately every 100 grams of fresh dates provides us with about 150 calories, while dried dates contain more calories. Every 100 grams of dried dates gives us about 280 calories. Dried dates do not need any preservatives; as the sugars they contain act as preservatives. Dates are a great source of iron, as every 100 grams of them contain 0.9 grams of iron. This represents about 11% of our body's daily need for this element. It is known to us that iron is part of hemoglobin inside the red blood cells in the blood, which transports oxygen. Dates also contain potassium, which is important for the body's cells and fluids and regulates heartbeat and blood pressure, which means it helps prevent strokes and heart disease. Dates are also rich in salts such as calcium, manganese, copper and magnesium. Calcium is a salt necessary for bones and teeth, muscle contractions, blood clotting, and the transmission of nerve signals. As for manganese, the body needs it as a cofactor for

DOI: 10.21608/esm.2024.363675

¹Pesticide Chemistry and Technology Dept., Laboratory of Bioenergetics and Membrane Toxicology, Faculty of Agriculture, El-Shatby, Alexandria University, Egypt

² Home Economics Department, Faculty of Specific Education, Alexandria University, Alexandria, Egypt

Received, May 15, 2024, Accepted, June 25, 2024.

antioxidant enzymes, copper we need in the formation of red blood cells, and magnesium is essential for bone growth. It also contains good levels of vitamin K and vitamins that belong to the B-complex group, and a good level of vitamin B6. These vitamins are auxiliary factors that help the body carry out metabolic processes. Vitamin K is considered an auxiliary factor in the metabolic processes of blood and bones (Al-Ali, 2012). In general, the composition of dates includes a varying number of salts and minerals, often ranging from 1.2 to 3.83 percent. This variation is influenced by variables such as cultivars and environmental factors (Al-Busaidi, 2012). Recognized for their rich nutritional profile, dates are consumed for their energy-boosting properties and significant mineral content. This review delves into the nutritional and medicinal value of key minerals found in dates, such as potassium, magnesium, calcium, and iron, and their roles in human health and disease prevention. Based on the information provided, it may be inferred that dates have the requisite characteristics to be considered a crop that contributes to food security. Dates can be a dependable and nourishing food source during times of scarcity, as well as being convenient for transportation and resolving poverty-related concerns.

Nutritional value of mineral elements in dates

The mineral content in dates varies with cultivar, soil conditions, and harvest timing. Key minerals present in dates include potassium, magnesium, calcium, and iron are crucial for various physiological functions and overall health. Dates are rich in vital minerals, includes potassium, phosphorus, sodium, zinc, manganese, magnesium, copper, iron, fluorine, and selenium. Dates are a potent source of potassium, which is essential for the proper functioning of the body's neurological system and overall wellness. Phosphorus collaborates with calcium to enhance bone strength and promote growth. Moreover, selenium plays a crucial role in cellular proliferation and regeneration. Iron is essential for the synthesis of erythrocytes, which transport all essential nutrients to cells throughout the entire body. Table (1) shows the major and minor elements of the two famous varieties, Halawi and Zuhdi (based on dry weight).

The sodium content in dates was determined to be low but optimal in relation to the recommended daily intake for an individual (exceeding 2.4-2.0 mg/day). Excessive sodium consumption can elevate the likelihood of developing heart disease and hypertension. Therefore, dates are optimal for promoting a nutritious way of life due to their presence of lowering sugars, low salt levels, absence of fat or cholesterol, high amounts of potassium and calcium, and dietary fiber. The dietary fiber content of commonly available dates has been

calculated to be 4.4%, with 3.2% being insoluble fiber and 1.2% being soluble fiber. According to certain sources, the amount of dietary fiber can vary between 6.4% and 11.5%, and these variations are attributed to the level of maturity. Thus, if an adult consumes seven dates per day, they would obtain 50-100% of the required daily fiber intake. Therefore, scientific evidence has demonstrated that dates are a superior snack compared to those that contain synthetic preservatives. Fluorine in dates has been shown to be essential in avoiding tooth decay. Selenium is an essential component of toothpaste, playing a vital role in protecting against cancer and boosting the immune system. Dates contain a large amount of carbohydrates, namely sugars such as fructose, glucose, mannose, maltose, and other non-reducing sugars like sucrose.

Table 1. Macro- and microelements of two types of Iraqi dates, Halawi and Zuhdi (mg/100g dry weight)

Elements	Variety	
	Zuhdi	Halawi
Macro elements		
Calcium	207	184
Phosphorus	14	16
potassium	887	854
sodium	5	14
Chlorine	342	260
Magnesium	59	56
Micro-elements:		
iron	10.37	5.26
Manganese	5.16	5.86
copper	2.75	2.77
zinc	0.74	1.39
Cobalt	0.95	0.76
Fluor	0.12	0.20

Source: Yousef, A. and Kado, A. (1982). Chemical composition of four Iraqi date cultivars. Baghdad: Agriculture and Water Resources Research Center.

The proportion of reducing sugars, specifically glucose and fructose, varies according on the kind of dates (dry, semi-dry, or moist) and the specific variety. In the Deglet Nour variety, sucrose is the primary type of sugar, whereas in the Alig cultivar, the most plentiful type of sugar is a reducing sugar. Studies have demonstrated that rutab dates contain much lower levels of sucrose compared to lowering sugars. The variation in sugar content between the Alej, Zaghoul, Ajlani, and Sakoti cultivars can be explained by the potential presence of high invertase activity in the Alej cultivar. This pattern is similar to the sugar levels observed in the Zaghoul, Ajlani, and Sakoti cultivars, which correspond to wet, semi-dry, and dry dates, respectively (Table 2). The sugars in apricots, bananas, oranges, and dates contribute to the energy produced by 1 kilogram

of these fruits, which is 520, 970, 480, and over 3000 calories, respectively. Conversely, a quantity of 1 kilogram of cooked rice, wheat flour, or lean meat yields 1800, 2295, and 2245 calories accordingly.

Table 2. The percentage of sugars in some types of dates

Variety	Total sugar	Reduced sugar	Unreduced sugar (sucrose)
Zaghloul (Rotab)	80.70	79.50	1.20
Ajlani (semi-dry)	78.80	35.40	43.40
Sakoti (dry)	78.70	14.40	63.30

Source: Ibrahim, A. M. and Kholaf, M. N. (1998). Date palm production and hasbandry (in Arabic). Egypt: Al-Maaref Press.

Dates are abundant in many vitamins, including B-carotene (vitamin A), thiamin (B1), and riboflavin (B2). Nevertheless, the composition differs based on the type and level of ripeness. Wet dates have a higher concentration of vitamin C (ascorbic acid) compared to dry dates. Several studies have shown that fully mature fruits contain a significant quantity of carotenoids, such as lutein and other types of beta-carotene. However, the overall number of carotenoids decreases as the fruits reach their last stages of ripening and during storage. In addition, dates are a good source of folic acid. Table 3 shows the vitamin contents of two varieties of dates based on dry weight, namely Al-Halwa and Al-Zohdi.

Table 3. Vitamin content of two types of Iraqi dates, Halawi and Zuhdi (mg/100g dry weight)

Vitamin Type	Variety	
	Zuhdi	Halawi
Thiamine (B ₁)	80	99
Riboflavin (B ₂)	167	173
Biotin (H)	5.74	4.63
Folic acid (folacin)	63	57
Ascorbic acid (C)	2.41	3.56

Source: Yousef, A. and Kado, A. (1982). Chemical composition of four Iraqi date cultivars. Baghdad: Agriculture and Water Resources Research Center.

Regarding the phenolic compounds present in dates, it has been discovered that dates contain various types of phenolic compounds, including phenolic acids, hydroxycinnamates, flavonoids, and tannins. These chemicals have positive effects on human health by acting as antioxidants and regulating cellular homeostasis. Phenolics serve as a defensive mechanism against infections. Research has shown that consuming six to seven dates, which is around 100 grams, on a daily basis can fulfill 50-100% of the required daily

intake of dietary fiber for adults.

Research suggests that palm fruit extract may play a role in safeguarding the liver of rats against oxidative stress and hepatotoxicity produced by sub-chronic exposure to dimethoate at a dosage of 20 mg per kilogram per day. This chemical induces an overproduction of free radicals, which are accountable for many cellular alterations in the organism. The study presented proof that pre-treatment with palm extract reversed the liver damage caused by dimethoate. This was shown by the suppression of the oxidation of lipids in the liver and the prevention of liver toxicity caused by oxidative stress. In addition, rat investigations have demonstrated that date palm extract has the ability to effectively decrease feces and gastrointestinal motility. The study determined that palm extract may include certain pharmacologically active compounds that have antidiarrheal characteristics.

Medicinal value of mineral elements in dates:

1-Why do our bodies need minerals?

Minerals are essential for the appropriate development of bodily fluids, such as blood, and are also crucial for the right development of tissues, bones, teeth, muscles, and neurons. Minerals have a crucial role in preserving the proper functioning of nerves, controlling muscular movement, and promoting cardiovascular health. The human body needs many existing minerals, known as essential minerals, and they are divided into two categories: major minerals and trace minerals. Essential minerals, like calcium, potassium, salt, phosphorus, sulfur, and magnesium, are needed in larger amounts. However, trace minerals such as iron, zinc, copper, selenium, fluoride, manganese, and iodine are as vital and indispensable for sustaining life. Among God's blessings upon us is that He has provided us with palm fruits in their various forms: fresh dates, dry dates, and semi-dry dates. These different forms contain many mineral elements, whether macro or micro, which play an important role in the health of the mind and the health of the body. Below we will review the importance of mineral elements for human health.

2-Calcium

Calcium constitutes a significant portion of the composition of bones and teeth. It facilitates regular bodily movement by maintaining the hardness, strength, and flexibility of tissues (Heaney 2012). Calcium helps promote strong bones and teeth, and is also essential for maintaining healthy communication between the brain and other parts of the body. It is known that calcium deficiency may lead to bone fractures, so the benefits of calcium are often linked to supporting bone and dental health. Ionized calcium buildup in the bloodstream, extracellular fluid, and different tissues regulates the

narrowing and widening of blood vessels, muscle and heart activity, blood clotting, neuronal transmission, and hormone release. Nutritional Value of calcium, a 100g serving of dates provides approximately 64 mg of calcium (Al-Farsi & Lee, 2008). Medicinal Value of Calcium is crucial for bone and teeth development and maintenance. It also plays roles in blood clotting, muscle contraction, and nerve signaling. Adequate calcium intake is essential for preventing osteoporosis and supporting cardiovascular health (Vayalil, 2012). Regarding the calcium content in various dates, it has been observed that they typically contain a quantity ranging from 59 to 168 mg per 100 g of de-seeded fruits. Calcium is well-known for its role in bone and teeth formation, as well as its influence on nerve response to external stimuli and regulation of muscle contraction. Additionally, calcium is essential for blood clotting and has been associated with the reduction of blood pressure and the incidence of colon cancer. (Power et al,1999).

3-Phosphorus

Phosphorus is vital for the formation and restoration of bones and teeth, as well as for enhancing nerve function. Phosphorus primarily serves the purpose of facilitating the development of skeletal structures, such as bones and teeth. Additionally, it plays a crucial part in the body's use of carbs and lipids by means of phosphorylation via kinases. It is also necessary for the body to produce protein for cell and tissue growth, maintenance and repair. Phosphorus also helps the body produce ATP, which is an important biomolecule as a source of energy for the body. Therefore, phosphorus, an essential mineral, is naturally present in many foods, including dates, with an average of 15 mg/100 g dry dates. Phosphorus is an essential constituent of bones, teeth, DNA, and RNA (Heaney 2012). Phosphorus is a constituent of the cell membrane structure and the primary generator of energy in the body, ATP, in the form of phospholipids. A multitude of proteins and carbohydrates undergo phosphorylation within the human body. Furthermore, phosphorus is essential for controlling gene transcription, activating enzymes, maintaining the correct pH of the extracellular fluid, and storing energy within cells. Phosphorus constitutes around 1 to 1.4% of the fat-free mass in humans. Out of this quantity, 85% is located in the bones and teeth, while the remaining 15% is evenly spread throughout the blood and soft tissues. It is also involved in the utilization of carbohydrates and fats and is necessary for synthesizing proteins for growth, maintenance, and repair of cells and tissues. Moreover, scholarly investigations have shown that dates possess a phosphorus content that varies from 63 to 72 mg per 100 g of de-seeded fruit. Phosphorus play a role in Muscle development and protection against poisonous

chemicals, together with the construction of teeth and bones (the latter being a crucial component for this purpose), are essential functions. Additionally, the integration of metabolic systems required for tissue respiration and the generation of energy chemical bonds, as well as the maintenance of the body's acid-base balance, are of paramount importance. (Clancy& McVicar 2007).)

4-Potassium

Potassium, the predominant cation within cells, is a vital nutrient present in dates at a concentration of approximately 800 mg per 100 g of dried dates. Potassium is present in all bodily tissues and is crucial for maintaining appropriate cell function. This is because it plays a vital role in regulating intracellular fluid volume and the electrochemical gradient across the cell membrane (Stone et al., 2016). The intracellular concentration of potassium is roughly 30 times more than the external concentration. This disparity creates a transmembrane electrochemical gradient, which is upheld by the ATPase transporter for sodium and potassium (Na^+/K^+). Furthermore, this gradient is essential for the maintenance of cellular tension, as well as for the appropriate conduction of nerves, contraction of muscles, and functioning of the kidneys. The mineral content in dates varies with cultivar, soil conditions, and harvest timing. Key minerals present in dates include potassium, magnesium, calcium, and iron, among others. These minerals are crucial for various physiological functions and overall health. Dates are an excellent source of potassium, with approximately 656 mg per 100g serving (Al-Farsi & Lee, 2008). Potassium is essential for maintaining cellular function, regulating heartbeat, and muscle and nerve function. It counteracts sodium's effects, aiding in blood pressure regulation and cardiovascular health. Adequate potassium intake is associated with reduced risks of stroke and hypertension (Baliga et al., 2011). Dates are found to possess a potassium content that varies from 648 to 790 milligrams per 100 grams of fruit after the removal of seeds. The significance of potassium cannot be overstated due to its various physiological functions. It aids in the absorption of nutrients and elimination of bodily waste, facilitates proper nerve and muscle functioning, maintains the equilibrium of renal and cellular pressure, and regulates the acid-base balance in bodily fluids. Inadequate potassium levels can result in detrimental health effects such as osteoporosis, muscular weakness, and decreased appetite. (Ali, 2023)

5-Sodium

Dates contain a low percentage of sodium, averaging 9mg/100g of dry dates. Sodium helps with muscle contraction and fluid balance in the body. Sodium plays an essential role in transmitting nerve signals in the

nervous system through channels called Na⁺-channels. The human body requires a minimal quantity of sodium to facilitate the transmission of nerve signals, facilitate muscular contraction and relaxation, and uphold the proper equilibrium of water and minerals. Approximately 500 mg of salt per day is required for these essential processes. Excessive use of sodium in one's diet can result in elevated blood pressure, cardiovascular disease, and stroke.

Dates have a sodium content that varies from 3 to 10 mg per 100 g. Dates contain low levels of sodium, which is beneficial since excessive sodium intake is linked to hypertension. Sodium is necessary for fluid balance and nerve transmission. Sodium plays a crucial role in regulating cellular osmotic pressure and water transport throughout the body. Additionally, it is essential for proper nerve and muscle function. Sodium is a constituent of intracellular fluid composition and aids in maintaining the acid-base balance of bodily fluids. (Madhavan et al., 2023)

6-Chlorine

Dates contain an average concentration of chlorine, about 300 mg/100 g dry dates. Chloride is an essential nutrient for metabolism. Chlorine is necessary for the production of hydrochloric acid in the stomach and for cellular pump functions. Low levels of chloride in the blood lead to cerebral dehydration. Chlorine, primarily found in the form of chloride ions, is an essential element in human nutrition. It plays a critical role in maintaining osmotic balance, aiding in the formation of gastric hydrochloric acid, which is essential for digestion, and is involved in maintaining acid-base balance in the body (Smith & Jones, 2018).

7-Magnesium

Magnesium serves as a cofactor in about 300 enzyme systems that govern various biochemical reactions in the body. These reactions include protein synthesis, muscle and neuron function, blood glucose regulation, and blood pressure control (Rude 2012). Magnesium is vital for the generation of energy, the process of oxidative phosphorylation, and the metabolic pathway of glycolysis. It plays a vital role in the formation of bones and is necessary for the production of DNA, RNA, and the antioxidant glutathione. Magnesium is involved in the active transportation of calcium and potassium ions across cell membranes, which is crucial for the transmission of nerve impulses, muscular contraction, and maintaining a regular heart rhythm (Rude 2012). Magnesium participates in more than 300 enzymatic activities, encompassing energy generation, protein synthesis, and the functioning of muscles and nerves. It supports immune health, maintains a steady heartbeat, and promotes bone health. It also helps regulate blood glucose levels (Baliga et al.,

2011). Moreover, dates are shown to possess a magnesium content ranging from 50 to 114 mg per 100 g of de-seeded fruit. The regulation of heart rate and blood pressure during muscular action, as well as the support provided to the immunological, muscle, and neural systems, are among the key tasks of this particular entity. Inadequate levels of this entity may result in symptoms such as fatigue, muscle spasms, overall weakness, and palpitations. In recent studies, a correlation has been established between magnesium and cancer, indicating a detrimental effect. (Hartwig, 2001).

8-Iron:

Dates contain a low percentage of iron, averaging 8 mg/100 g dry dates. The body uses iron in the formation of hemoglobin, which carries oxygen in the blood. It is considered one of the essential micronutrients, and the body needs it to perform many vital functions, and it is very important for growth and development. Iron is vital for hemoglobin formation, which transports oxygen in the blood. It is also involved in energy production and immune function. Iron is a critical component of hemoglobin, the protein in red blood cells responsible for oxygen transport from the lungs to the rest of the body. It also plays a role in energy production and immune function. Adequate iron intake helps prevent anemia, characterized by fatigue and weakened immune function

9-Copper

Dates contain a low percentage of copper. Copper is an essential mineral for the health of the body. It is found in all tissues of the body, and is involved in the synthesis of red blood cells and the formation of some important enzymes. It also has a role in preserving nerve cells and supporting the immune system. There are larger quantities of copper metal in the human body, in the liver, brain, heart, kidneys, and skeletal muscles. Copper has a role in collagen formation, iron absorption, and energy production, and it is worth noting that hyper copper blood, or blood copper deficiency, both affect the functioning of the brain (Hellman and Gitlin 2002). Copper is present in relatively low concentrations. Studies have shown that dates contain approximately 0.36 mg of copper per 100 grams of dry weight (Al-Farsi & Lee, 2008). Copper is a trace element that plays a vital role in several physiological processes. It is a key component of various enzymes, such as cytochrome c oxidase, which is involved in cellular respiration, and superoxide dismutase, which protects cells from oxidative damage (Turnlund, 2006). Additionally, copper is crucial for the synthesis of hemoglobin, the formation of connective tissue, and the maintenance of the nervous and immune systems (Uauy, Olivares, & Gonzalez, 1998). Despite

its low concentration in dates, the presence of copper contributes to the overall nutritional value of this fruit. Regular consumption of dates, along with other copper-containing foods such as nuts, seeds, and whole grains, can help meet the recommended daily intake of copper, which is about 0.9 mg for adults (National Institutes of Health, 2020). The low percentage of copper in dates highlights the importance of a varied diet to ensure adequate intake of all essential nutrients. While dates alone may not provide significant amounts of copper, they complement other dietary sources to help fulfill the body's nutritional requirements.

10-Zinc

Zinc plays a vital role in immunological function, protein synthesis, wound healing, DNA synthesis, and cell division. Additionally, it facilitates regular growth and maturation throughout pregnancy, childhood, and adolescence. Zinc is classified as a micronutrient because it plays a crucial role in the growth and replication of cells involved in gene expression. This is particularly important throughout pregnancy, childhood, and adolescence. Zinc additionally enhances the immune system and facilitates the healing of wounds.

11-Chrome

Chromium is a vital mineral that contributes to the mechanism by which insulin assists the body in controlling blood sugar levels. Insulin is an endocrine hormone that facilitates the conversion of sugar, carbohydrates, and other dietary substances into the necessary energy required for everyday physical tasks. There is data indicating that chromium supplementation may be beneficial in reducing blood sugar levels in individuals with diabetes. Individuals with diabetes either have insufficient insulin production or impaired insulin use. Consequently, glucose, often known as sugar, accumulates in the bloodstream Broadhurst & Domenico (2006). Studies have demonstrated that chromium enhances insulin sensitivity and decreases cardiovascular function, hence corroborating the findings on chromium's impact on insulin. Insulin is a versatile hormone that has metabolic actions and plays a role in regulating blood sugar levels specifically in skeletal muscles. Insulin promotes the absorption of glucose by initiating a cascade of signal transduction mechanisms that commence with the attachment of insulin to the extracellular α subunit of the insulin receptor (IR) located on the cell membrane (Figure 1) (Myers and White 1993). The interaction between insulin and the α subunit of the insulin receptor (IR) triggers the autophosphorylation of the intracellular β subunit, leading to the activation of the intracellular tyrosine kinase domain. Upon activation, the IRS enzyme phosphorylates several tyrosine residues on insulin receptor substrates 1 and 2 (IRS-1 and IRS-2,

respectively), using a catalytic process. Phosphorylation of tyrosine residues on IRS-1 and IRS-2 increases their binding to Src-homology 2 domains, which in turn promotes the interaction between IRS-1 and the p85 regulatory subunit of phosphatidylinositol 2-kinase (PI3K). This ultimately leads to the movement of glucose transporter 4 (Glut4) from the cytoplasm to the cell surface, facilitating the regulation of cellular glucose uptake.

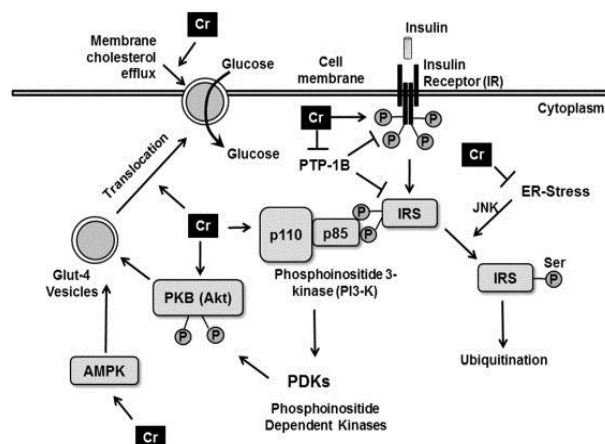


Fig. 1. The effect of chromium on increasing the sensitivity of insulin receptors on the cell surface of diabetics

Source: M.G. Myers Jr., M.F. White (1993) The new elements of insulin signaling. Insulin receptor substrate-1 and proteins with SH2 domains. Diabetes, 42, 643-650

12-Selenium

It is one of the types of minerals and secondary elements that the body needs. It is usually found naturally in some types of foods, and is also found in very small quantities in drinking water and soil. It plays an important role in the body, especially when it comes to regenerating tissues and repairing damage to them because it possesses antioxidant properties. Selenium also helps protect the body from free radicals that cause various diseases, and is involved in the production of DNA, in addition to its role in the functioning of thyroid hormones, strengthening the immune system, and improving fertility.

13-Phosphorus:

Phosphorus is essential for bone and teeth formation. It is involved in the utilization of carbohydrates and fats and is necessary for synthesizing proteins for growth, maintenance, and repair of cells and tissues. Moreover, scholarly investigations have shown that dates possess a phosphorus content that varies from 63 to 72 mg per 100 g of de-seeded fruit. play a role in muscle development and protection against poisonous chemicals, together with the construction of teeth and

bones. Additionally, the integration of metabolic systems required for tissue respiration and the generation of energy chemical bonds, as well as the maintenance of the body's acid-base balance, are of paramount importance.

14-Sodium:

Dates have a sodium content that varies from 3 to 10 mg per 100 g. Dates contain low levels of sodium, which is beneficial since excessive sodium intake is linked to hypertension. Sodium is necessary for fluid balance and nerve transmission. Sodium plays a crucial role in regulating cellular osmotic pressure and water transport throughout the body. Additionally, it is essential for proper nerve and muscle function. Sodium is a constituent of intracellular fluid composition and aids in maintaining the acid-base balance of bodily fluids. Sodium is a vital electrolyte in the human body, playing critical roles in maintaining fluid balance, nerve function, and muscle contraction (Farley, 2014). The human body requires sodium to conduct nerve impulses, contract and relax muscles, and maintain the proper balance of water and minerals (He & MacGregor, 2008). Despite its importance, excessive sodium intake is associated with increased risks of hypertension, cardiovascular diseases, and stroke (Appel et al., 2011). The low sodium content in dates makes them an excellent dietary choice for individuals seeking to reduce their sodium intake. This is particularly beneficial given the modern dietary trend of high sodium consumption, often exceeding the recommended daily limit of 2,300 mg for adults, as advised by health organizations like the American Heart Association (American Heart Association, 2020). Incorporating dates into the diet can contribute to overall mineral intake without significantly increasing sodium levels. Additionally, dates provide a host of other nutrients, including potassium, magnesium, and dietary fiber, which further support cardiovascular health. The balance of low sodium and high potassium in dates is particularly beneficial, as potassium helps to mitigate the effects of sodium on blood pressure (Whelton et al., 2012).

CONCLUSION

Dates are an exceptional source of essential minerals that substantially contribute to overall health and well-being. Their high content of potassium, magnesium, calcium, and iron is particularly beneficial, offering a range of health advantages. Potassium is vital for maintaining cardiovascular health by regulating blood pressure and preventing stroke. Magnesium is crucial for bone health, muscle function, and numerous enzymatic reactions involved in energy production and metabolism. Calcium is indispensable for maintaining bone density and structural integrity, while iron is

essential for the production of hemoglobin and preventing anemia. The regular dietary inclusion of dates can therefore have significant positive impacts on cardiovascular and bone health, as well as enhancing various metabolic functions. Moreover, the exploration of the specific bioactive compounds present in dates and their mechanisms of action holds promise for uncovering additional medicinal benefits. Future research should focus on isolating these compounds and understanding their roles at the molecular level, which could potentially lead to the development of new therapeutic strategies and health supplements. The comprehensive nutritional profile of dates underscores their potential as a functional food with broad-ranging health benefits, warranting further scientific investigation and integration into dietary guidelines.

REFERENCES

- Agoudjil, B., Benchabane, A., Boudenne, A., Ibos, L., & Fois, M. (2011). Renewable materials to reduce building heat loss: Characterization of date palm wood. *Energy and Buildings*, 43(2–3):491–497.
<https://doi.org/10.1016/j.enbuild.2010.10.014>
- Al-Ali, L. S. (2012). What do we mean by the nutritional value of dates. *Blessed tree*, 4 (1) 42–47.
- Al-Busaidi, A. (2012). 5 Fertilizer Application. *Dates: Production, Processing, Food, and Medicinal Values*, 67.
- Al-Farsi*, M. A., & Lee, C. Y. (2008). Nutritional and functional properties of dates: a review. *Critical reviews in food science and nutrition*, 48(10), 877–887.
- Ali, A. A. H. (2023). Overview of the vital roles of macro minerals in the human body. *Journal of Trace Elements and Minerals*, 100076.
- American Heart Association. (2020). Sodium and Salt. Retrieved from American Heart Association.
- Appel, L. J., Frohlich, E. D., Hall, J. E., Pearson, T. A., Sacco, R. L., Seals, D. R., ... & Van Horn, L. V. (2011). The Importance of Population-Wide Sodium Reduction as a Means to Prevent Cardiovascular Disease and Stroke: A Call to Action from the American Heart Association. *Circulation*, 123(10), 1138–1143.
- Aschner JL, Aschner M. Nutritional aspects of manganese homeostasis. *Mol Aspects Med* 2005; 26:353–62
- Assirey, E. A. R. (2015). Nutritional composition of fruit of 10 date palm (*Phoenix dactylifera* L.) cultivars grown in Saudi Arabia. *Journal of Taibah University for Science*, 9(1), 75–79. <https://doi.org/10.1016/j.jtusci.2014.07.002>
- Ayad, A. A., El-Rab, D. G., Shahbazi, A., Worku, M., Schimmel, K., Ejimakor, G., Zimmerman, T., & Ibrahim, S. A. (2016). Using date palm (*Phoenix dactylifera* L.) by-products to cultivate *Lactobacillus reuteri* spp. *Journal of Food Research*, 5(5), 77–81.
<https://doi.org/10.5539/jfr.v5n5p77>
- Broadhurst, C. L., & Domenico, P. (2006). Clinical studies on chromium picolinate supplementation in diabetes mellitus—a review. *Diabetes Technology & Therapeutics*, 8(6), 677–687.
- Buchman AR. Manganese. In: A. Catharine Ross BC, Robert J. Cousins, Katherine L. Tucker, Thomas R. Ziegler ed. *Modern Nutrition in Health and Disease*. 11th ed.

- Baltimore, MD: Lippincott Williams & Wilkins; 2014:238-44.
- Clancy, J., & McVicar, A. (2007). Short-term regulation of acid-base homeostasis of body fluids. *British Journal of Nursing*, 16(16), 1016-1021.
- Farley, T. A. (2014). Sodium: How to Tame the Silent Killer. *Annual Review of Public Health*, 35, 109-123.
- Hartwig, A. (2001). Role of magnesium in genomic stability. *Mutation research/fundamental and molecular mechanisms of mutagenesis*, 475(1-2), 113-121.
- Hassan, I., Cotrozzi, L., Haiba, N., Basahi, J., Ismail, I., Almeelbi, T., & Hammam, E. (2017). Trace elements in the fruits of date palm (*Phoenix dactylifera* L.) in Jeddah City, Saudi Arabia. *Agrochimica*, 61(1), 75.
- He, F. J., & MacGregor, G. A. (2008). A Comprehensive Review on Salt and Health and Current Experience of Worldwide Salt Reduction Programmes. *Journal of Human Hypertension*, 23, 363-384.
- Heaney RP. Calcium. In: Coates PM, Betz JM, Blackman MR, et al., eds. *Encyclopedia of Dietary Supplements*. 2nd ed. London and New York: Informa Healthcare; 2010:101-6.
- Heaney RP. Phosphorus. In: Erdman JW, Macdonald IA, Zeisel SH, eds. *Present Knowledge in Nutrition*. 10th ed. Washington, DC: Wiley-Blackwell; 2012:447-58.
- Hellman NE, Gitlin JD. Ceruloplasmin metabolism and function. *Annu Rev Nutr* 2002;22:439-58.
- Ibrahim, A. M. and Kholaif, M. N. (1998). Date palm production and hasbandry (in Arabic). Egypt: Al-Maaref Press.
- Madhavan Unny, N., Zarina, A., & Beena, V. (2023). Fluid and Electrolyte Balance. In *Textbook of Veterinary Physiology* (pp. 193-211). Singapore: Springer Nature Singapore.
- National Institutes of Health. (2020). Copper: Fact Sheet for Health Professionals. Retrieved from NIH Office of Dietary Supplements.
- Power, M. L., Heaney, R. P., Kalkwarf, H. J., Pitkin, R. M., Repke, J. T., Tsang, R. C., & Schulkin, J. (1999). The role of calcium in health and disease. *American journal of obstetrics and gynecology*, 181(6), 1560-1569.
- Rude RK. Magnesium. In: Ross AC, Caballero B, Cousins RJ, Tucker KL, Ziegler TR, eds. *Modern Nutrition in Health and Disease*. 11th ed. Baltimore, Mass: Lippincott Williams & Wilkins; 2012:159-75.
- Smith, L., & Jones, P. (2018). Essential Minerals in Human Nutrition. *Nutrition Reviews*, 76(2), 127-134.
- Stone MS, Martyn L, Weaver CM. Potassium intake, bioavailability, hypertension, and glucose control. *Nutrients* 2016;8
- Turnlund, J. R. (2006). Copper. In *Present Knowledge in Nutrition* (pp. 458-470). International Life Sciences Institute.
- Uauy, R., Olivares, M., & Gonzalez, M. (1998). Essentiality of Copper in Humans. *The American Journal of Clinical Nutrition*, 67(5), 952S-959S.
- US Department of Agriculture, A. R. S. (2011). USDA national nutrient database for standard reference, release 28. Nutrient data laboratory home page.
- Vayalil, P. K. (2012). Date fruits (*Phoenix dactylifera* Linn): An emerging medicinal food. *Critical Reviews in Food Science and Nutrition*, 52(3), 249-271. <https://doi.org/10.1080/10408398.2010.499824>
- Vayalil, P. K. (2012). Date fruits (*Phoenix dactylifera* Linn): An emerging medicinal food. *Critical Reviews in Food Science and Nutrition*, 52(3), 249-271.
- Whelton, P. K., He, J., Appel, L. J., Cutler, J. A., Havas, S., Kotchen, T. A., ... & National High Blood Pressure Education Program Coordinating Committee. (2012). Primary Prevention of Hypertension: Clinical and Public Health Advisory from The National High Blood Pressure Education Program. *JAMA*, 288(15), 1882-1888.
- Yousef, A. and Kado, A. (1982). Chemical composition of four Iraqi date cultivars. Baghdad: Agriculture and Water Resources Research Center.
- Baliga, M. S., Baliga, B. R., Kandathil, S. M., Bhat, H. P., & Vayalil, P. K. (2011). A review of the chemistry and pharmacology of the date fruits (*Phoenix dactylifera* L.). *Food Research International*, 44(7), 1812-1822.

الملخص العربي

القيمة الغذائية والطبية للعناصر المعدنية في التمر

محمود مسعود أبوالسعد^١ ، سمر محمد شعوير^٢

ارتفاع نسبة البوتاسيوم في التمر مفيد للأشخاص الذين يعانون من ارتفاع ضغط الدم. كما يعد البورون مفيداً جداً في علاج سرطان الدماغ ، بالإضافة إلى الفيتامينات الأخرى ، ويستخدم أيضاً في علاج الروماتيزم (Vayalil 2012). إن وفرة الفلورين الموجودة في التمر مفيدة للوقاية من تسوس الأسنان. علاوة على ذلك ، يمكن أن يساعد محتوى التمر من السيلينيوم في الوقاية من السرطان وتقوية جهاز المناعة البشري. وفقاً لدراسة سابقة ، تتراوح كمية السيلينيوم في بعض أصناف التمر بين ١,٤٨ و ٢,٩٦ ميكروغرام / غرام (Vayalil 2012). كما يمكن استخدام التمر كمكملات غذائية لنقص الحديد دون التسبب في آثار جانبية مثل الغثيان والصداع وفقدان الشهية التي يمكن أن تحدث مع استخدام مكملات الحديد التقليدية. يعتبر التمر أيضاً مصدراً جيداً للفيتامينات مقارنة بالفواكه المجففة الأخرى (US Department of Agriculture, A. R. S., 2011). إلى ذلك ، تحتوي الطازج على تركيزات أعلى من الفيتامينات مقارنة بالتمر المجفف نتيجة استفاد الفيتامينات أثناء عملية التجفيف. يتواجد الثيامين والريبوفلافين والنياسين وحمض الأسكوربيك والبيريدوكسين وفيتامين أ في التمر المجفف بتركيزات منخفضة نسبياً (Hassan et al 2017).

التمر مصدر غني بالمعادن ويحتوي على ما لا يقل عن ١٥ معدن مختلفة مثل المغنيسيوم والمنجنيز والفوسفور والحديد والكالسيوم والبوتاسيوم والصوديوم والزنك. تتراوح النسبة المئوية لكل معدن في التمر المجفف بين ٠,١ - ٩١٦ مجم / ١٠٠ جرام من لحم التمر (Agoudjil et al. 2011). (Ayad et al 2016) يحتوي التمر أيضاً على مستويات عالية من النحاس والسيلينيوم والبوتاسيوم والمغنيسيوم ، وتركيزات متوسطة من المنجنيز والحديد والفوسفور والكوبالت والفلور والزنك والكالسيوم والكروم، بالإضافة إلى كميات صغيرة من البورون (Agoudjil et al. 2011)، وجد أن الكروم يلعب دوراً جوهرياً لمرضى السكر من النوع الثاني حيث يزيد من ارتباط الإنسولين مع مستقبلاته على سطح الخلية وبالتالي يسمح بمرور السكر لاستفادة منه في العمليات الحيوية بدلاً من خروجه مع البول. العديد من أصناف التمر ، يمكن أن يصل محتوى البوتاسيوم في اللب إلى ٠,٩٪ ، بينما يمكن أن تحتوي الأنوية على ٠,٥٪. ويعتبر البوتاسيوم هو العنصر الدقيق السائد في لحم التمر ، في حين أن محتوى الفوسفور أقل من العناصر الكبيرة الأخرى (Assirey 2015). تم التعرف على بعض العناصر الدقيقة منها الزنك والنحاس بتركيزات منخفضة في التمر ، بينما يوجد الحديد بتركيزات أعلى (Assirey 2015). وجد أن