


CELLULOSE DATE PALM MEMBRANE AND DIGESTIVE RISKS

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ABSTRACT

Many plants, including some of the commonly consumed herbs and spices in our daily food, can be safely and effectively used to prevent and/or treat some health concerns. Date palm fruits possess high nutritional and therapeutic value with significant antioxidant, antibacterial, antifungal, and anti-proliferative properties. This review focuses on the date fruit extracts and their benefits in individual health promoting conditions and highlights their applications as useful to the pharmaceutical and nutraceutical industries in the development of natural compound-based industrial products.

Key words: *Date palm, therapeutic value, antibacterial, antifungal, anti-proliferative*

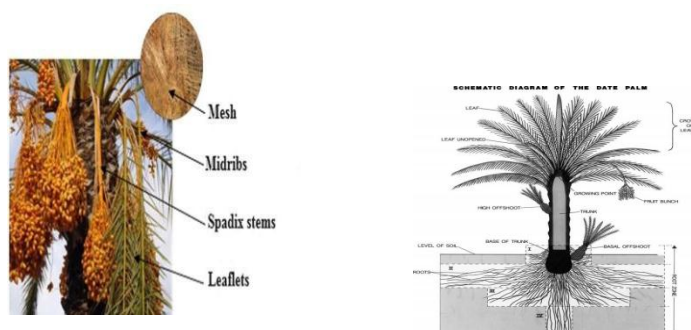
INTRODUCTION

Date palm (*Phoenix dactylifera* L.) is one amongst the oldest fruit crops grown within the arid regions of the Arabian Peninsula, North Africa, and also the geographical area. play significant roles in the economy, society, and environment in these areas. In addition to serving directly as a food source. The date palm is a diploid, perennial, dioecious, and monocotyledonous plant adapted to arid environments. It has unique biological and developmental characteristics that necessitate special propagation, culture, and management techniques. Thousands of *Phoenix dactylifera* cultivars and selections exist in several date-growing countries. The long life cycle, long period of juvenility, and dioecism of date palms make breeding challenging. Worldwide date production has grown from 1,809,091 t in 1962 to 6,924,975t in 2005. Worldwide date production will still grow. According to statistics at the Second International Conference on Date Palms, the Arab Republic of Egypt ranks first in date production, followed by Saudi Arabia, then Iran, then the United Arab Emirates, and so Algeria. And The total palm planted within the Arab country, according to Al-Juhani census in 2007, was approximately 85 million trees.

Type of Date palm :

Dabbas-from United Arab Emirates -Ajwah – from the town of Medina in Saudi Arabia - Al-Khunaizi – from the town of Qatif in Saudi Arabia - Mishriq – from Sudan and Saudi Arabia- afawi - mainly grown in

Asian country within the Al-Madina region - Sukkary- It's cultivated primarily in Al Qassim, Saudi Arabia. Khalasah – one in every of the most important palm cultivars in Kingdom of Saudi Arabia. Its fruit is named Khlās



Notably produced in Hofuf (Al-Ahsa) and Qatif within the Eastern Province of Kingdom of Saudi Arabia - Aabel – common in Libya - Barakawi – from Sudan some of thanks to palm irrigation , Surface irrigation methods: transferring quantities of water from irrigation networks and channels on to the permanent. Among its most vital methods. Irrigation in Al-Bouaki: one amongst the foremost widely used methods in sandy lands, it's a bunch of trees arranged in rows, separated from one row to a different by a basin called Al-Baka.

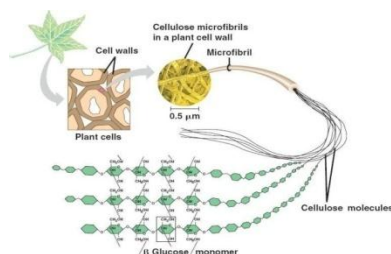
Irrigation within the basin: dividing the basins into geometric shapes. Each basin contains a number of palm trees ranging between 4-6 palms

Line irrigation: the farmer resorts to making variety of lines between the trees by plowing, on the idea of the slope line or the control line

Irrigation with terraces: the agricultural land is split into several pieces, trees are planted in the heart of those divided pieces, and therefore the taps are opened to require out the irrigation water and distribute it between the terraces Sprinkler irrigation is best fitted to sloping and irregular areas. It's lifted through a series of tubes suspended within the air, and also the water begins to fall within the kind of a mist.

Drip irrigation is one among the foremost widely used methods in Asian nation. It's done by pumping quantities of water within precisely calculated quantities and in step with certain times within the form of droplets from droppers directly connected to small plastic tubes, and therefore the number of droppers varies. In keeping with the age and size of the palm. Dates are rich in carbohydrates, energy, glucose, fructose and sucrose, which are absorbed in the upper gastrointestinal tract, but they contain

high amounts of dietary fiber, which is principally found within the form of insoluble fiber in smaller quantities than soluble fiber. It's been observed that polyphenol levels vary consistent with the kind of date and degree of maturity. We are going to also mention during this research that dates contain high levels of polyphenols and insoluble cellulose that may cause health problems once they reach the colon. this can be the rationale that some farms and irrigation use water contaminated with sewage that carries strains of coliform bacteria that may cause problems. When ingested, these bacteria can collect within the cellulose barrier around the seed. Cellulose is created from many glucose anhydride molecules linked together by covalent bonds an interesting fact about cellulose is that it can't be dissolved in alkaline solutions and includes a high resistance to acid solubility, except for



high concentrations of strong acids, unlike lignin or hemicellulose, cellulose may be a chemically stable substance which makes it a carrier component of plant cells and imparts strength to the fibers, while natural fibers have a hollow structure thanks to the presence of so-called cavities. The cavity helps absorb water and retain water within the fibers; So it causes the fibers to stretch. The cellulose act as filters in dates membrane. Understanding the mechanisms of solute adsorption onto solid surfaces is critical for ensuring that contaminants are far away from solution, Dipole–dipole, dipole induced dipole, and hydrogen bonding, chemical bonding, and natural process are samples of oppositely charged ionic interactions. supported the raw date pits (RDP) chemical structure. The RDP is formed up of three primary components: cellulose, hemicellulose, and lignin, yet as other constituents like oil, protein, and so on. Both cellulose and hemicellulose contain the bulk of oxygen functional groups found in lignocellulosic material, like hydroxyl, ether, and d carbonyl, whereas lignin may be a complex, systematically polymerized, highly aromatic substance that acts as a cementing matrix that holds both cellulose and hemicellulose units together. The adsorption mechanisms are determined by parameters like pH_{Zpc}, surface functional groups, and pores size. The inclusion of diverse functional groups like

alcohols, phenolic hydroxides, and ethers makes the RDP acidic (pH 4.6). Through ion -exchange processes, metal ions can form complexes with RDP surface functional groups such cellulose–OH and phenolic–OH. The functioning of those groups doesn't alter at lower pH . These groups begin to neutralize at increasing pH levels, affecting their activity and binding capabilities. In some cases using cheap and eco-friendly filters or membranes like cellulose material for water purification from harmful bacteria.

How it pass to the intestine

Digestion is different in herbivores and humans. The animals listed above eat cellulose in their natural diet primarily (plant fiber) Unlike humans, herbivores can break down and make this cellulose fiber fat and protein. Herbivores ferment with the aid of microorganisms with several stomachs (ruminant herbivores). Bacteria essentially digest the herbivore cellulose.



We crush food in the mouth, which breaks down some starches by amylase (enzyme). In the stomach pepsin (another enzyme) breaks down proteins. It dissolves everything again with a high level of hydrochloric acid (pH 1.5-3, average 2. The acidic slurry is called "chyme" — and we can see immediately that "meat rots in your belly" are baloney. In a pH2 hydrochloric acid and pepsin vat there is no 'red'. [5][6]

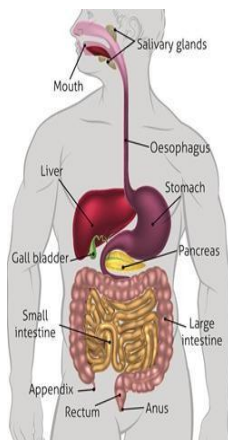
On average, it takes 4-5 hours for a "mixed meal" (including meat) to quit fully — so we have another myth shattered. (Remember we haven't yet absorbed any nutrients: we still crumble all.) [5][6]

Our small intestine releases the remaining into our large intestine

— a giant bacterial colony that literally contains trillions of bacteria! And because our own enzymes can't

break down all we eat, the reason we have a bacterial colony in our colon. So our intestinal bacteria work and digest some of the rest of them, sometimes producing waste we can absorb. (There are a lot of farts.) The remaining indigestible plant matter ("cellulose fiber"), dead intestinal bacteria and waste are produced as fecal materials.[5][6] The result is the fine task of broken up meat proteins, pepsins, trypsin and chymotrypsins, and our other proteases, and bile salts and lipases make a good task of breaking down animal fat. That is, meat is digested by our own bodies' enzymes. Our main reason for digesting our gut bacteria is that our digestive enzymes can't break down sugars, starches, and fiber.[5][6]

Importantly, it is here that dietary fiber is fermented into SCFAs (mainly butyrate, acetate, and propionate) by the indigenous anaerobic colonic bacteria, which serve as the principal carbon energy source for colonocytes. There is a link between SCFA levels and microbiota composition, with high luminal concentrations resulting from fermentation lowering colonic pH (5.5– 6.5 in the proximal colon, compared to pH 6.5–7.0 in the distal colon) and inhibiting Gram-negative Enterobacteriaceae growth, including the pathogens *Salmonella* spp. Eating a lot of dietary fiber will negatively affect the person because of the large production of SCFAs from anaerobic bacteria and thus affect the colon with infections or appendicitis. ..[7]



Cellulose is made up of long unbranched glucose chains (1-4) and a connected D- glucopyranose. The straight chains are tightly linked together by many intermolecular hydrogen bonds in their pure form, resulting in a water insoluble fibrous material that is generally inert. Modified celluloses differ from pure cellulose in terms of chemical characteristics. In nature, there is a lot of cellulose, because it is

found in nearly all plant tissues, it is a frequent food source for us. [8]

Dietary cellulose is not thought to be processed in the stomach or small intestine, with 85 percent of ileostomy contents recovered from subjects fed diets containing commonly consumed items.

However, it is fermented by the microflora in the large intestine, resulting in the synthesis of short chain fatty acids, hydrogen, carbon dioxide, and methane. [8]

The metabolism of cellulose in humans has long been a source of fascination, but progress has been hampered by a scarcity of precise chemical tools for measuring it. Another explanation is that natural cellulose, which is found in plant cell walls is toxic.

Kelleher describes trials in which 10 healthy people were given a single dose of ^{14}C - cellulose and then collected feces and breath samples for seven days to measure the amount of cellulose digestion and metabolism. The total amount of ^{14}C recovered was 73 percent, with 57 percent in the feces and 16 percent in the breath. Individual differences were found to be quite wide. For example, feces recovered 47-80 percent of the dosage. The emergence of $^{14}\text{C}\text{O}_2$ in the breath within one hour of the test dose of ^{14}C -cellulose was an unexpected finding. However, when they received it, they observed that it still had starch granules, and they were able to remove another 30% of the radioactivity via gelatinisation, starch hydrolysis, and acid washing. [8] As a result, it's still plausible that the test substance contained minor amounts of non-cellulosic material, which might explain $^{14}\text{C}\text{O}_2$'s early presence in breath. The ^{14}C excreted in feces has an unknown chemical form. In the solid phase, ^{14}C can be found in a variety of forms, including microbiological solids and undegraded cellulose. [8]

The degradability of this cellulose will most likely be underestimated in the absence of more exact information. Carryer employed ^{131}I -labeled cellulose in the only comparable investigation of isotopically labeled cellulose breakdown in the human stomach.

In just five days, they were able to collect 87 percent of the material from their victims' feces. The chemical form of the isotope in feces was not characterized, hence the degree of any degradation is unknown. Non isotopic approaches have been used to get sample evidence for cellulose breakdown in humans. In human balance studies where dietary cellulose intake and faecal excretion were monitored and the source of cellulose was commonly consumed foods such fruits and vegetables and refined cereals, cellulose digestibility was on the order of 70-80%. These and other reports have led to a more

in-depth investigation of cellulose metabolism in humans, employing pure forms of cellulose .[8]

These cellulose preparations have substantially different physical properties than the cellulose found in plant cell walls, leading to differing perspectives on cellulose's role in the gut. Other than chemical purity, various factors influence the breakdown of cell wall cellulose. Lignin, cutin, and silica all inhibit fermentation in ruminants, according to research.

In humans, wheat bran's relative resistance to digestion of cellulose and other cell wall polysaccharides can be explained in part by its high lignin content compared to other human diets.[8]

Most fruits and vegetables have only one-tenth of the amount of lignin found in bran. The rate of cellulose breakdown is also affected by the particle size of cellulose-containing preparations.

The amount of time cellulose spends in the gut fermentation chamber, whether it's the rumen or the large intestine, is crucial in determining how much it breaks down.[8]

This is undoubtedly true in rumen investigations, and evidence for this in humans is growing.

The elderly had a substantially higher cumulative recovery of ^{14}C in breath (23 percent elderly versus 10 percent young) and a lower faecal recovery (52 percent elderly vs 64 percent young).

If the authors' assumptions of CO_2 excretion of 9 mmol/kg body weight/h are equally valid in both age groups, this could indicate higher deterioration in the elderly.[8]

Although the data for transit are not presented in the publication, transit duration was not substantially related to faecal cellulose recovery when measured as the recovery of 80% of an oral dosage of radio-opaque pellets. In Stephen's studies²⁴, using codeine phosphate to extend transit time from 47 to 88 hours had no effect on cellulose digestion,

(70 percent control versus 75 percent + codeine phosphate), and she discovered that when the transit period is more than 50 hours, the digestion of the cellulose supplied in her trial reaches a 75 percent plateau. Is cellulose in the gut physiologically important?

Purified cellulose, unlike other cell-wall polysaccharides, does not lower serum cholesterol levels in humans and only slightly enhances fecal bile acid excretion when administered in acceptable amounts. In vitro, bile acids do not bind to cellulose.[8]

Cellulose inhibits glucose absorption in rats^{33 34}, but no human trials have been conducted. More research has been done on the effects of cellulose on the large intestine. Purified cellulose doses ranging from 15-20 g/day given to volunteers in long-term feeding studies result in small increases in stool production, a reduction in transit time, and a decrease in stool pH.

In several animal experiments, cellulose has been shown to protect against colon cancer. Because cellulose's water holding capacity is so low, its method of action in the large intestine is most likely connected to its digestibility. The breakdown of cellulose in the colon promotes microbial proliferation, whereas any undigested cellulose provides a surface for bacteria, potentially resulting in the creation of specialized subpopulations. Short-chain fatty acids are produced by fermenting cellulose, which necessitates a complicated interaction of microorganisms.

Clearly, cellulose can alter human gut function, particularly in the large intestine. However, cellulose is found in our diet as part of the plant cell wall, where it is closely linked to a variety of other carbohydrate polymers. Its effects are less predictable and difficult to determine in this form. Because of the constraints of chemical analysis, measuring cellulose intake in humans is difficult: published values for the cellulose content of regularly consumed foods vary by a factor of ten. The most up-to-date analytic approaches,

However, studies show that cellulose accounts for less than 20% of dietary plant cell wall polysaccharides. It's still unclear whether native cellulose has any special qualities in the human gastrointestinal tract.

Methods

In this research we used the (experiment) method, so that we work in this research to detect microorganisms in the dates coming from the farms, our research aims to clarify the extent of microbial diversity present in the dates and the source of this diversity that comes from it, what we are trying to prove in this research is what if the date membrane causes digestive problems as it is a cellulose membrane, and can the body analyze it quickly, and is it possible for microbes to cross through this membrane when crossing the digestive system and cause diseases through this intestinal pollution?

The experiment was conducted on different types of dates known in Saudi Arabia, such as Ajwa, Khalas, Al Barni and Sukkarah, from different regions such as the south and west of Jeddah, Madinah and Al Ahsa,

and from different farms.

We took date pulp, inner membrane and kernel and put each of them in distilled water and then cultured them on sabraoud, mackonkey and neutrient medium and were incubated for 24 hours. After 24 hours, we confirmed that it was pure and not contaminated or mixed, then it was isolated again, then it was stained and viewed under the microscope, and we conducted a biochemical test on it to detect the type of microbe that appeared. The sample was a diverse mixture of colonies, where the most visible microbes were (Bacillus, E.coli and Micrococcus) and E.coli (the predominant type in all samples due to lactose fermenter in the medium of the mackonkey, so we went deeper to reveal the classification of E.coli, which was isolated and stained with (Eosin methylene blue) EMB, later turned out to be E.coli metallic sheen.

Tools and Results

Effects of indigested date extract and date polyphenol extract on specific bacterial groups .

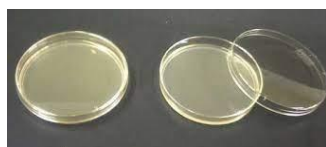
After experiments with cultivation on several cultures such as :agar culture :

Agar, or agar-agar, is widely used as a culture medium for growing microorganisms. .The stuff itself is also the product of micro-organisms

MacConkey agar :

is a culture medium designed for the growth of Gram-negative bacteria and a dye by fermenting lactose.

Sabouraud agar :



or Sabouraud dextrose agar (SDA) is a type of agar growth medium containing peptones.

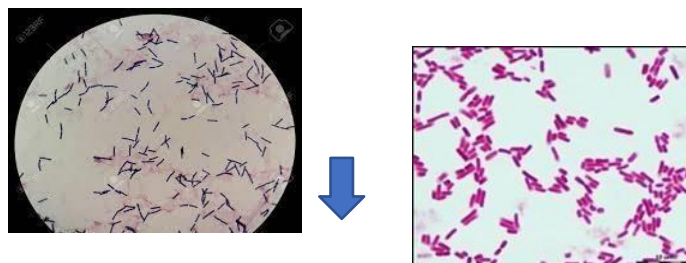
[1] It is used to cultivate dermatophytes and other types of fungi, and can also grow filamentous bacteria such as Nocardia. It has utility for research and clinical care .



Result after 24 hours :

It was confirmed that it was pure and not contaminated or mixed after another was isolated, then it was dyed and viewed under the microscope, and we conducted a biochemical test on it to detect the type of microbe that appeared.

The sample was a diverse mixture of colonies, The following appeared to us..



Bacillus- coagulans is a type of bacteria. It is used similarly to lactobacillus and other probiotics as "beneficial" bacteria

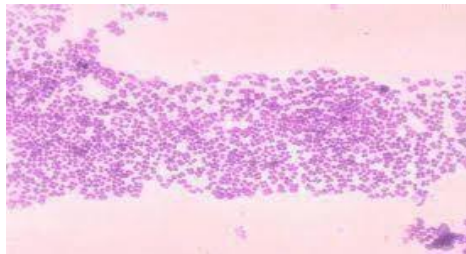
Bacillus, (genus Bacillus), any of a genus of rod-shaped, gram- positive, aerobic or (under some conditions) anaerobic bacteria widely found in soil and water. The term bacillus has been applied in a general sense to all cylindrical or rodlike bacteria. The largest known Bacillus species . **E. coli (Escherichia coli)**- is a type of bacteria that lives naturally in the intestines . Most types of **E. coli** are harmless and help maintain a healthy digestive system. But some strains can cause diarrhea if you eat a contaminated date or drink a date that has been watered with contaminated water

E.coli was the predominant type in all samples due to lactose fermenter in the environment of the mackonkey, so we went deeper to reveal the classification of the type of **E.coli**, it was isolated and stained with (Eosinmethylene blue) EMB, it was then found that it is **E.coli** metallic sheen .

EMB : Eosin methylene blue agar (EMB) is a selective and differential medium used to isolate fecal coliforms.

Normally-colored or colorless colonies indicate that the organism ferments neither lactose nor sucrose and is not a fecal coliform. *Escherichia coli* often produces a metallic green sheen on EMB .

Micrococcus- is a genus of Gram-positive cocci belonging to the family Staphylococcaceae nonmotile, non-spore-forming cocci these anaerobic bacteria causes disease.



Conclusion

Despite the fact that date palm trees serve an important social and economic function in arid and semi-arid climates KSA In dry climates, the date palm is one of the oldest fruit crops. It has biological and developmental characteristics that necessitate the use of specialized propagation, culture, and control techniques. The cellulose in the dates membrane acts as a filter. Understanding the mechanics of solute adsorption on solid surfaces is essential for keeping impurities out of solution. Dipole–dipole, dipole-induced dipole, and hydrogen bonding are all examples of dipole–dipole interactions

Cellulose is a 'fiber' material that dieticians and nutritionists have identified as beneficial when food travels swiftly and efficiently through the digestive tract. Fiber-rich diets are thought to lower the risk of colon cancer by reducing the amount of time waste materials are exposed to colon walls. Many glucose anhydride molecules are joined together by covalent bonds to form cellulose. A fascinating characteristic about cellulose is that it cannot be dissolved in alkaline solutions and has a high acid solubility resistance. In Asian countries, drip irrigation is one of the most extensively employed systems. It is accomplished by pumping water in the form of droplets from droppers directly attached to small plastic tubes in precisely calculated amounts and at specific times, with the number of droppers varying. Long unbranched glucose chains (1-4) and a linked D-glucopyranose make up cellulose. In their pure state,

the straight chains are tightly connected by multiple intermolecular hydrogen bonds, resulting in a water insoluble fibrous substance that is generally inert that cellulose synthesis is the main cause of biofilm formation

We took different types of dates from different regions and put their samples in distilled water and isolated them and How do we know that the bacteria is E.coli? Presence Lactose fermenter in Maconkey, In the future test : taking the largest number of dates in the Kingdom of Saudi Arabia and the quality of the water

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