Annals of Plant Sciences 8.8 (2019) pp.3591-3596

ANNALS OF PLANT SCIENCES
ISSN: 2287-688X
OPEN ACCESS
www.annalsofplantsciences.com

Review Article

A review on chemical composition and pharmacological properties of *Cocos nucifera* (L.) oil and water

Reetu Dubey, Sanjukta Rajhans*, Dhruv Pandya, Archana U. Mankad
Department of Botany, Bioinformatics and Climate Change Impacts Management, School of Science, Gujarat University, Ahmedabad, Gujarat, India.

Abstract: *Cocos nucifera* (L.) (Coconut) is a palm tree belonging to the family Arecaceae, a native to Philippines and Malaysia. It is considered as one of the most useful plants for humankind because of its nutritive value and economic importance. *Cocos nucifera* oil and water contents are rich in a variety of chemical constituents and posses varied potent therapeutic and pharmacological properties such as anti-microbial, anti-inflammatory, anti-oxidant, anti-malarial, anti-cardioprotective, anti-parasitical, analgesic activity, antineoplastic, cooling agent, etc. In this article, we review the chemical constituents and pharmacological properties of *Cocos nucifera* oil and water.

Key words: *Cocos nucifera*, Chemical composition and Pharmacological properties.

Introduction

Cocos nucifera (L.) is a member of the palm tree family Arecaceae. It is an important tree which provides food to millions of people especially in the tropical and subtropical regions of the world. The palm is more prevalent in Asia and is found to be present in the intertropical zone since prehistorical times. It is often called the "tree of life" because of its infinite potential uses (Brow *et al.*, 2009; Ahuja *et al.*, *2014*; Shijna *et al.*, 2016). The term coconut was derived from the 16th century Portuguese and Spanish Word "coco" meaning "head or skull". The term refers to the seed or the fruit which is a drupe. Water and oil of this plant possess high nutritional and medicinal value.

This review has made an attempt to include the important chemical constituents and various pharmacological properties present in the oil and water content of the plant.

Morphological features of *Cocos nucifera* fruit:
Cocos nucifera fruit is large in size and bears characteristic flavor and aroma. The fruit comprises of nutritional water and has three main layers: Exocarp (hard skin), Mesocarp (husk) and Endocarp (shell) (Yong *et al.*, 2006; Shivashankar *et al.*, 2017).

Chemical composition of *Cocos nucifera* water:
Cocos nucifera water comprises of 90 - 95% trace amounts of carbohydrates, fats, proteins, oils, vitamins and minerals (Yong *et al.*, 2006; Tan *et al.*, 2014). Nutrients from *C. nucifera* water are obtained from the seed apoplasm (Singla *et al.*, 2011). Sweetness of the *C. nucifera* water is due to the sugars like Fructose, Glucose and Sucrose (Campbell-Falck *et al.*, 2000; Tan *et al.*, 2014). The water is rich in organic acids such as fatty acid, malic acid, succinic acid, citric acid, acetic acid and tartaric acid (DebMandal and Mandal, 2011). The water also contains a variety of inorganic ions. It is a well-known drink because of its high nutritional value and effective rehydration potential (Yong *et al.*, 2006; Tan *et al.*, 2014). The basic ion composition of the water can replenish the electrolytes of the human body excreted through sweat such as sodium, potassium, magnesium and calcium (Arora *et al.*, 2011). *C.nucifera* water is rich in amino acids like alanine, cysteine, arginine, serine (Vigliar *et al.*, 2006; DebMandal and Mandal, 2011; Tan *et al.*, 2014). As the fruit matures it becomes rich in enzymes like peroxidase and polyphenol oxidase (DebMandal and Mandal, 2011).

***Corresponding Author:**
Reetu Dubey,
Department of Botany,
Bioinformatics and Climate Change Impacts Management,
School of Science, Gujarat University,
Ahmedabad-380009, Gujarat, India
E-mail: reetudubey22@gmail.com

C. nucifera water contains water soluble vitamins in particular vitamins B- Biotin, Niacin, Folic acid and Vitamins C (ascorbic acid) (Vigliar *et al.*, 2006; Yong *et al.*, 2006; Shenkin, 2006). The water also possesses hormones like auxin, cytokinin, gibberellic acid and abscisic acid (Ge *et al.*, 2006; Yong *et al.*, 2006). N6 isopentenyladenine dehydro-zeatin, trans-zeatin, kinetin orthro-topolin, dihydro-zeatin, kinetin riboside, trans-zeatin riboside-5 monophasphate, O-glucoside, trans-zeatin O-glucoside are among the cytokinin compounds identified in *C.nucifera* water (Ge *et al.*, 2005; Ge *et al.*, 2006; Yong *et al.*, 2006). A change in the pH value is observed in the water of *Cocos nucifera* when the fruit begins to mature (Jackson *et al.*, 2004; Terdwongworakul *et al.*, 2009; Tan *et al.*, 2014).

Chemical composition of *Cocos nucifera* oil:

C. nucifera oil has rich nutritive value (Akubugwo *et al.*, 2008; Kyari, 2008). Phenolic compounds of *Cocos nucifera* consists of tocotrienols, polyphenols and tocopherols. Triglyceride compounds that contain large amount of saturated medium chain fatty acids are also found to be present in the oil (Marina *et al.*, 2009). Example of triglyceride compounds are palmitic acid and palmitoleic acid. Flavor components like Ethyl lactate, Phenylethyl alcohol are also found to be present in the oil (Chumbimuni-Torres and Kubota 2006; Borse *et al.*, 2007). In *C.nucifera,* Lauric acid is the most abundant fatty acid. Other fatty acids that are found to be present are Capric acid, Caproic acid, Stearic acid, Palmitoleic acid, Palmitic acid, Oleic acid, Linoleic acid, Linolenic acid etc. (Oyi *et al.*, 2010; Bouaid *et al.*, 2010; Bello *et al.*, 2015) It contained total higher phenolic compound (Massey, 2001; Akubugwo *et al.*, 2008; Oyi *et al.*, 2010)

Pharmacological effect of *Cocos nucifera* water:

Cocos nucifera water exhibits anti-microbial activity (Ricardo *et al.*, 2004; Karadi *et al.*, 2011; Arora *et al.*, 2011). The antibacterial property is due to the presence of lauric acid. The water also exhibits antioxidant activity which is due to its rich content of Vitamin C, inorganic ions, phenolic compounds and flavonoids (Dey *et al.*, 2005; Yong *et al.*, 2006; Shenkin, 2006; Unagul *et al.*, 2007; Tan *et al.*, 2014). Antiparasitic activity is observed in this plant. The water is used to control gastrointestinal nematodes (Borse *et al.*, 2007; Oliveira *et al.*, 2008; Lima, *et al.*, 2015). *C. nucifera* water protects against myocardial infraction and cardiovascular disorders (Scalbert *et al.*, 2005; Burtis *et al.*, 2008; Pattigadapa *et al.*, 2011; Appaiah *et al.*, 2015). According to the Malaysian folk medicine *C.nucifera* water has the potential to cure malaria (Borse *et al.*, 2007; Al-Adhroey *et al.*, 2011).

Cocos nucifera water has potential to therapeutic properties (Campbell-Falck *et al.*, 2000; DebMandal and Mandal, 2011). The water also possesses anti-cancer properties (Nurulain, 2006; Prabhu *et al.*, 2011; Appaiah *et al.*, 2015). Cytokinin kinetin which is present in *C.nucifera* water shows anti-thrombotic activity (Vermeulen *et al.*, 2002; Hsiao *et al.*, 2003; Appaiah *et al.*, 2015). Component of *C.nucifera* water such as polysaccharides, lectins, protein and peptides present in plant have been shown to stimulate the immune system (Tzianabos, 2000; Bafina and Mishra, 2005). Tender *C. nucifera* water has been used in coronary heart disease (Mandal *et al.*, 2009; Pattigadapa *et al.*, 2011; Appaiah *et al.*, 2015). The water increases insulin level and helps in balancing of blood glycogen level (Bhagya *et al.*, 2010; Pinto *et al.*, 2015; Nidhi *et al.*, 2017). It also found to be rich in active chemicals which control HIV infection (Nagata *et al.*, 2011; Li Q *et al.*, 2009). *C.nucifera* water and kernels are used to treat asthma, bronchitis, burns, constipation, dysentery and diarrhea (Esquenazi *et al.*, 2002). *C. nucifera* water is also good for treating anaemia and helps in the reduction of haemolytic anaemia (Ajayi and Arishe, 2015; Ajayi and Igwillo, 2016). The water has a capacity to dissolve kidney stones (Spencer, 2007; Aggarwal *et al.*, 2017). The water also helps in reduction of the blood pressure and total cholesterol (Massey, 2001; Bhagya *et al.*, 2010; Bandeira *et al.*, 2017). The water is also effective as a potential hepatoprotective agent (Loki and Rajamohan, 2003; DebMandal M. and Mandal, 2011).

Pharmacological effect of *Cocos nucifera* Oil:

Numerous studies have shown that *Cocos nucifera* oil possesses powerful anti-inflammatory activity. It can be used effectively to treat inflammation associated with various wounds (Intahphuak *et al.*, 2010; Dua *et al.*, 2011; Manisha and Shyamapada, 2011). Many studies have also reported the antioxidant activity of *C. nucifera* oil. The presence of phenolic compounds in *C. nucifera* oil is mainly responsible for the antioxidant activity (Zakaria *et al.*, 2011; Arunima and Rajamohan, 2011; Hanaa *et al.*, 2013; Otuechere *et al.*, 2014).

C. nucifera oil also possesses powerful antimicrobial properties that have been revealed when tested on various strains of microorganisms (Esquenazi *et al.*, 2002; Rajeev *et al.*, 2011; Sia *et al.*, 2013). Virgin *C. nucifera* oil possesses antiviral, antimicrobial and antiprotozoals properties (Bergsson *et al.*, 2002; Deb-

Mandal and Mandal, 2011; Shilling *et al.*, 2013). The effectiveness of *C.nucifera* oil is due to the active compound monolaurin, a monoglyceride, which is a product of lauric acid metabolisation (Srivastava and Durgaprasad, 2008; Oyi *et al.*, 2010; Hristov *et al.*, 2011). *C.nucifera* oil also possess vasorelaxant effect and antihypertensive activity (Bankar *et al.*, 2011; Al-Adhroey *et al.*, 2011; Singla *et al.*, 2011).

Conclusion

Cocos nucifera (L.) is one of the most useful plants for the mankind. They are widely distributed in tropical regions of the world. This palm possesses many nutritional substances. *Cocos nucifera* water rich in sugar and protein content, organic and inorganic components, vitamins and enzymes and its oil contain diverse saturated fatty acid or unsaturated fatty acid. It possesses many medicinal and pharmacological properties. It has been exploited for its tremendous nutritional and pharmacological properties. Each and every part of the plant is used in some or the other way. Here in this paper only the usefulness of the water and oil has been discussed.

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Cite this article as:
Reetu Dubey, Sanjukta Rajhans, Dhruv Pandya, Archana U. Mankad. A Review on chemical composition and pharmacological properties of *Cocos nucifera* (L.) oil and water. *Annals of Plant Sciences* 8.8 (2019) pp. 3591-3596.
http://dx.doi.org/10.21746/aps.2019.8.8.1

Subject Editor: Dr. Shaik Mannur Ismail, *University Malaysia Terengganu, Malaysia*.

Source of support: Nil; **Conflict of interest:** Nil.