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Review Article

Cocos Nucifera: It's Pharmacological Activities

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ABSTRACT

Coconut, Cocos nucifera L., is a tree that is cultivated for its multiple utilities, mainly for its nutritional and medicinal values. Coconuts are exotic, edible fruits produced in coconut trees. The coconut tree is a kind of palm tree with a single straight trunk and has been used for many purposes since prehistoric times. Every part has a use, including the fruits, wood, and leaves. Because of this, the trees are widely cultivated in many places in South India for both commercial and home use. From the coconut tree several products are obtained including coconut, tender coconut water, coconut toddy, coconut shell and so on. It's all parts are used. It is a unique source of various nutrients, and so it has many pharmacological activities including anti-inflammatory, anti-bacterial, anti- neoplastic, anti- diabetic etc. The coconut water and coconut kernel contain various micronutrients which is used for disease prevention and for maintain good health. And this current review describes about the nutrient facts and several pharmacological activities of Cocos nucifera.

Keywords: Coconut, pharmacological activities, nutrient facts, disease prevention.

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INTRODUCTION

The coconut tree of the palm family Arecaceae and it is of genus Cocos. The plant is originally from Southeast Asia and the islands between the Indian and Pacific oceans. From the region, the fruit of the coconut palm is believed to have been brought to India. This coconut palm is also known as coconut, coco, coco-da-Bahia or coconut of the beach. [1]

The team coconut is derived from Portuguese and Spanish word coco meaning head or skull. Coconut palm prefers the area with abundant sunlight and regular rain fall. Coconut needs high humidity of about 70-80% for optimum growth. Coconut palms require warm conditions for successful growth and are intolerant of cold weather. Coconut palms are grown in more than 90 countries of the world, with a total production of 61 million tones per year. Most of the world production is in Asia with Indonesia, Philippines and India 73% of the world total. The term coconut can refer to the whole coconut tree or the seed, or the fruit.

NUTRIENT FACTS

Amount per 100 gm	
Calories 354	
% Daily Value*	
Total Fat 33 g	50%
Saturated fat 30 g	150%
Polyunsaturated fat 0.4 g	
Monounsaturated fat 1.4 g	
Cholesterol 0 mg	0%
Sodium 20 mg	0%
Potassium 356 mg	10%
Total Carbohydrate 15 g	5%
Dietary fiber 9 g	36%
Sugar 6 g	
Protein 3.3 g	6%

*Per cent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

NUTRITIONAL VALUES

Coconut has multifarious utility. The liquid endosperm (tender coconut water (TCW)), is an excellent natural soft drink and it contains

Vitamin B, namely, nicotinic acid B3 (0.64 µg/ml)
Pantothenic acid B5 (0.52 µg/ml)
Biotin (0.02 µg/ml)
Riboflavin B2 (<0.01 µg/ml)
Folic acid (0.003 µg/ml)
Trace amount of thiamine B1 and pyridoxine B6 [2]

Besides coconut water contain sugars, sugar alcohols, vitamin C, folic acid, free amino acids, phyto-hormones such as auxin, 1, 3-diphenylurea, cytokinin and enzymes such as acid phosphatase, catalase, dehydrogenase, diastase, peroxidase, RNA polymerases and growth promoting factors

Copra, the dried kernel portion which is mainly used for oil extraction, contains about 65% to 75% oil .herein the important nutrition components are shown below. [3]

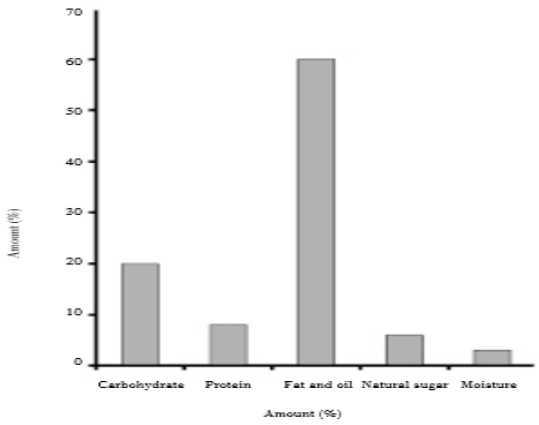

Fig: 1 Composition of desiccated coconut

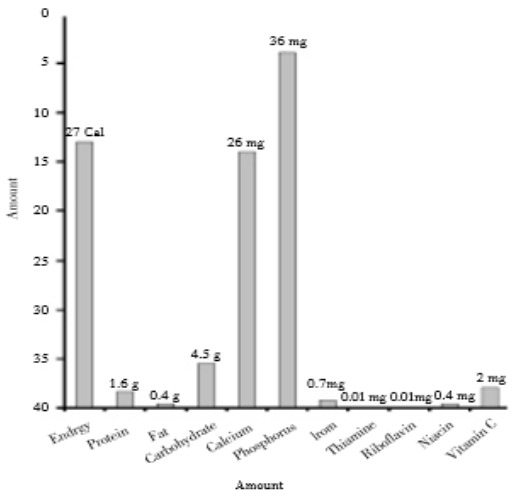

Fig 2: Nutritional composition of coconut milk

PHARMACOLOGICAL ACTIVITIES

Anti-inflammatory activity: The aqueous extract obtained from the husk of the C. nucifera have the anti- inflammatory activity. The formalin and subcutaneous air pouch test is conducted to prove the anti- inflammatory activity and showed that aqueous crude extracts of C. nucifera var. typica (50, or 100 mg/kg) significantly inhibited (Po0.05) the time that animals spent licking their formalin-injected paws and reduced inflammation induced by subcutaneous carrageenan injection by reducing cell migration, extravasation of protein, and TNF-a production. [4]

Anti-bacterial activity: Ethanolic dry-distilled, and aqueous extracts of coconut endocarp were compared with gentamicin and ciprofloxacin for their antibacterial activities against methicillin-resistant Staphylococcus aureus (MRSA), methicillin-sensitive S. aureus, Pseudomonas aeruginosa, Escherichia coli, Klebsiella pneumonia, Acinetobacter baumannii, Citrobacter freundii, Enterococcus, Streptococcus pyrogens, Bacillus subtilis, and Micrococcus luteus using the Kirby-Bauer disc diffusion method. The endocarp extracts showed strong antimicrobial activity against B. subtilis, P. aeruginosa, S. aureus, and M. luteus but had no effect on E. coli. [5]

Antioxidant activity: The diets rich in phenolic compounds can significantly enhance human health because of the effects of phenolic antioxidants. All among the oil obtained from the coconut the virgin coconut oil has high amount of phenols. The DPPH test is used to studying he anti-oxidant activity of virgin coconut and had higher antioxidant activity compared to refined coconut oi .the ethanolic and aqueous extract obtained from the endocarp of coconut have anti-oxidant activity comparable with that of standard ascorbic acid [6]

Antineoplastic activity: Different molecular weight fractions of husk fiber aqueous extracts of C. nucifera were tested on human erythro leukemia cell line K562 and Lucena 1, a multidrug-resistant (MDR) and vincristine resistant derivative of K562. Both varieties showed cytotoxicity against K562 cells and decreased by 50% the viability and anti-MDR activity of Lucena 1cells. In both varieties, the anti-tumoral activity was concentrated in fractions with molecular weights between 1 and 10 kDa. There is great potential for future research on antineoplastic activity, as only one study has been reported. Because coconut is extensively cultivated in Brazil and its fiber is often discarded, it may offer an inexpensive source for new antineoplastic drugs. [7]

Anti-parasitic activity: The ovicidal and larvicidal activity of the liquid from the coconut husk (LCCV) and butanol LCCV extract were tested against Haemonchus contortus. In egg hatching and larval development tests, 2.5 mg/mL LCCV and 10 mg/mL butanol extract showed 100% ovicidal activity. Their larvicidal effects were 81.30% and 99.80% at 65 and 80 mg/mL, respectively. These results suggest that coconut extracts can be used to control gastrointestinal nematodes and that more studies are needed to evaluate their use in humans. [8]

Anti-Leishmania activity: The leishmanicidal effects of C. nucifera on Leishmania amazonensis were evaluated in-vitro and the extract obtained from the coconut husk fiber which is rich in poly phenols completely inhibited the cellular growth of Leishmania amazonensis promastigote forms at minimum inhibitory concentration 10 mg/ml and killed 100% of both developmental stages of the parasite after 60 min at 10 and 20 mg/ml. Ethyl acetate extract (EAE) from husk fiber water was tested against L. braziliensis infected hamsters Administering EAE(0.2 mL, 300 mg/kg) for 21consecutive days did not reduce edema of infected footpad nor the weight of lymph node drainage but reduced skin lesions after 14 days. These results offer new promise for the development of drugs against leishmaniasis from coconut extracts because of their potent effects and the absence of in vivo allergic reactions or in vitro cytotoxic effects in mammalian systems. [9]

Depressant and anticonvulsant activity: The methanol extract from the roots of C.nucifera at concentration of 40, 60 and 80 mg/kg significantly increases the duration of sleep when compared with the drugs such as pentobarbital 40 mg/kg, diazepam 3 mg/kg, and meprobamate 100 mg/kg. The anticonvulsant action of ethanol extract of C. nucifera was also observed in pentylenetetrazol-induced seizure models. At 80 mg/kg no animals had seizures or died, even after 24 h. [10]

Antimalarial activity: The methanol extracts C. nucifera of concentrations 50, 100, 200 and 400 mg/kg was studies for the antimalarial activity. The drugs of concentration 20 mg/kg of Chloroquine and 1.2 mg/kg of Pyrimethamine were used as reference drugs. And it is studied in vivo against Plasmodium berghei in mice. The methanol white flesh extract of C. nucifera produced a dose dependent chemotherapeutic activity in all three in vivo assessment models. In the established malaria infection, the concentration of extracts 200 and 400 mg/kg shows significant decrease when compared to the two reference drugs used for the treatment of the disease. [11]

As an electrolyte: The tender coconut water (TWC) is rich in inorganic ions such as potassium 290 mg%, sodium 42 mg %, calcium 44 mg %, magnesium 10 mg %, Phosphorous 9.2 mg%. The presence of these inorganic electrolytes generates an osmotic pressure similar to that of the blood and does not affect plasma coagulation. [12]The TWC contains potassium in a high amount which helps to lowers the blood pressure. The ethanolic extract of C. nucifera endocarp was found to have a vasorelaxant and antihypertensive effect, through nitric oxide production in a concentration and endothelium dependent manner, due to direct activation of nitric oxide/ guanylate cyclase pathway, stimulation of muscarinic receptors and/or via cyclooxygenase pathway. [13]

Antidote effect: TCW is found to eliminate poisons in case of mineral poisoning, and ameliorate drug induced over dosage toxicity. The TCW aids the quick absorption of drug and makes their peak concentration in the blood easier by its electrolytic effect, which is similar to fructose coupled faster absorption into the cells and body. [13]

Cardio protective effect: Coconut is composed of the fatty acids caprylic acid (C-8:0), capric acid (C-10:0), lauric acid (C-12:0), myristic acid (C-14:0), palmitic acid (C-16:0), stearic acid (C-18:0), oleic acid (C-18:1), linoleic acid (C-18:2)[14] It is abundantly (65%) endowed with medium chain saturated fatty acids (MCFAs), which allows them to be directly absorbed from the intestine and sent straight to the liver to be rapidly metabolized for energy production and thus MCFAs do not participate in the biosynthesis and transport of cholesterol [14].

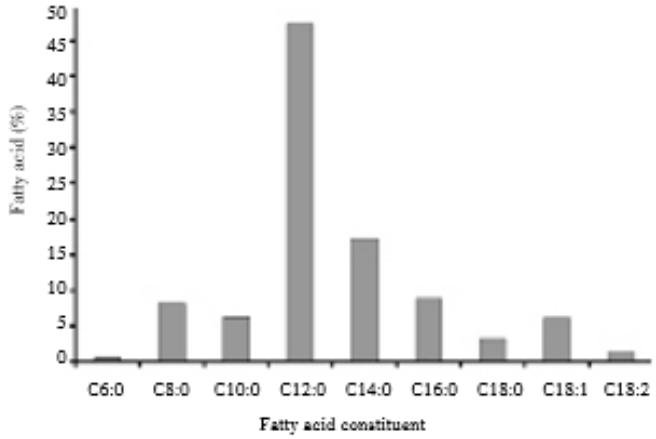

Figure 3: Fatty Acid Constituent

Coconut water has cardio protective effects in myocardial infarction due to rich content of mineral ions, especially potassium. The virgin coconut oil lowered total cholesterol, triglycerides, phospholipids, low density lipoprotein (LDL), very-low-density lipoprotein (VLDL), and increased high density lipoprotein (HDL)-cholesterol levels [15]. The polyphenol fraction of virgin coconut oil was found to prevent in vitro LDL-oxidation.

Antithrombotic effect: VCO has significant antithrombotic effect over copra oil [15]. Coconut oil is rich in high saturated fatty acids (HSAFA)-diet lowers postprandial t-PA (tissue plasminogen activator) antigen concentration, and this may favorably affect the fibrinolytic system and the Lp (a) (lipoprotein-a) concentration compared with the high mono and polyunsaturated fatty acid (HUFA)-diet. The coconut oil contains a large amount of dietary saturated fatty acids more than that of the saturated fat have a beneficial influence on Lp (a) levels [16].

Anti-atherosclerotic effect: Chlamydia pneumoniae will causes atherosclerosis by provoking an inflammatory process that result in the oxidation of lipoproteins with induction of cytokines and production of proteolytic enzymes, a typical phenomenon in atherosclerosis [14]. The coconut husk fiber contains catechin, epicatechin along with condensed tannins (B-type procyanidins), that showed inhibitory activity against acyclovir-resistant herpes simplex virus type 1. The saturated fatty acids ranging from C-6 to C-14, which include approximately 80% of the fatty acids in coconut oil are able to kill all members of the HSV family. [17]

Hypolipidemic effect: VCO is capable of reducing lipid peroxidation content. The hypolipidemic effect of coconut protein is due to the high content of L-arginine [18]. Besides the high polyphenol

content in coconut is capable of maintaining the normal levels of lipid parameters in tissues and serum aided by trapping of reactive oxygen species in aqueous components such as plasma and interstitial fluid of the arterial wall thereby inhibiting LDL oxidation, reversal of cholesterol transport and reducing intestinal absorption of cholesterol [19]

Anticholecystitic effect: It is urinary antiseptic and is effective in the treatment of kidney and urethral stones. Monooctanoin (from caprylic acid) is a digestion product of medium chain triglycerides, is a cholesterol solvent that has been used for the dissolution of retained cholesterol gallstones following cholecystectomy. Complete gallstone dissolution has occurred in approximately 50%-75% of patients receiving monooctanoin; although mechanical stone removal is still considered to be the treatment of choice for retained gallstones, monooctanoin use appears promising for stone dissolution in patients in whom mechanical removal has been unsuccessful or is impossible[20].

Antiprotozoal activity: The extract of C. nucifera which is rich in polyphenolic content at a concentration of 10µg/ml shows potent leishmanicidal activity by inhibiting the growth of promastigote and amastigote at the developmental stages of leishmanial amazonensis after 60mins. In traditional Mexican medicine, C. nucifera has been used to treat trichomoniasis [21].

Immuno stimulatory effect: The virgin coconut oil enriched with Zn increased Tc cells, Th cells, IL-2, but maintained the number of neutrophil and NK cells, while the IgG level changed from equivocal to negative in Candidiasis patient [22]. The coconut globulin, cocosin, is a legume class, 208 kDa reserve protein which belongs to the fourth group of proteins. An increasing levels of RBC, WBC, platelet, neutrophil, monocytes, eosinophil, B-lymphocytes, T-lymphocytes and Hb after feeding coconut protein to immunosuppressed animals, thus indicating strong immunomodulatory activity of coconut protein [23]

Antidiabetic effect: The coconut kernel protein has potent anti-diabetic activity through reversal of glycogen levels, activities of carbohydrate metabolizing enzymes and the pancreatic damage to the normal levels due to its effect on pancreatic β-cell regeneration by means of arginine [24].

Hepatoprotective activity: Hepato protective effect of TCW is evidenced from the histopathological studies of liver, which did not show any fatty infiltration or necrosis, as observed in CCl4-intoxicated rats [25].

Disinfectant activity: A disinfectant named bactericide has been prepared containing acetate amine of coconut acid as the active agent, which exerted a bactericidal and fungicidal action at 0.04% to 0.5% concentrations upon exposures for 2 to 10 minutes [26].

Hormonal effect: Young coconut juice is believed to contain phytoestrogen and other sex hormone-like substances which can be used in hormone replacement therapy, in reducing the risk of dementia and in wound healing in postmenopausal women, [27].

CONCLUSION

Coconut trees derive from the palm family, which includes many species of trees and plants. Coconut trees distinguish themselves as hardy species, surviving in tough climates with little water and high levels of salt. People use virtually every part of the coconut tree, including the fibers, juices, outer bark and fronds. Tree trunks serve industrial uses, making popular choices as housing materials and structural supports. Coconuts, the fruits produced by trees, provide food and nutrition. The coconut palm exerts a profound influence on the rural economy of the many states. The export earnings derived by India from coconut are around Rs 3 000 million. India's thrust now shall be to exploit the wealth potential of the crop in all respects. Moreover coconut is an ecofriendly crop which permits coexistence of multi-species plants. It enriches soil fertility in association with other crops and is quite amenable to organic farming if appropriate intercrops are grown in the inter-spaces. The versatile coconut tree is a source of various chemical compounds, which are responsible of the various activities of the tree. Recently, modern medicinal research has confirmed many health benefits of the multiple coconut products in various forms. A drug development program should be undertaken to develop modern drugs with the compounds isolated from coconut. Modern drugs require to be developed after extensive investigation of its bioactivity, mechanism of action, pharmacotherapeutics, after proper standardization and clinical trials. Further evaluation needs to be carried out on C. nucifera in order to explore the concealed areas and their practical clinical applications, which can be used for the welfare of the mankind.

CONFLICT OF INTERESTS

The authors declare no conflict of interests.

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