

# Curative and Protective Effect of Coconut (*Cocos Nucifera. L*) Inflorescence Sap (Neera)

Roopa B Patil<sup>1</sup> and Bhavana A<sup>2</sup>

<sup>1</sup>Assistant Professor, Department of Food Science and Nutrition, University of Agricultural Sciences, GKVK, Bengaluru

<sup>2</sup>Ph.D. Scholar, Department of Food Science and Nutrition, University of Agricultural Sciences, GKVK, Bengaluru

\*Corresponding Author: [bhavana7243@gmail.com](mailto:bhavana7243@gmail.com)

Coconut is a unique tree, where every part is useful in one way or another. Coconut has been in existence for millions of years and the people of the tropical world use a eulogistic epithet “Tree of Life” for coconut palms. Whatever is needed for one’s livelihood—food, fuel, medicine and shelter is available from this wonder palm. Coconut palm has been studied mostly from the commercial angle, as it is the source of edible oil, food, coconut water, coconut milk, fiber, wood and fuel. Because of the diversified food value, the potential of coconut can be exploited from the flowering phase to the mature nut. In India, it was grown in approximately 2 million ha with production of 20440 million nuts in 2014-15 (CDB, 2015). It plays an important role in the Indian economy, contributing \$105 million per year to the national GDP.

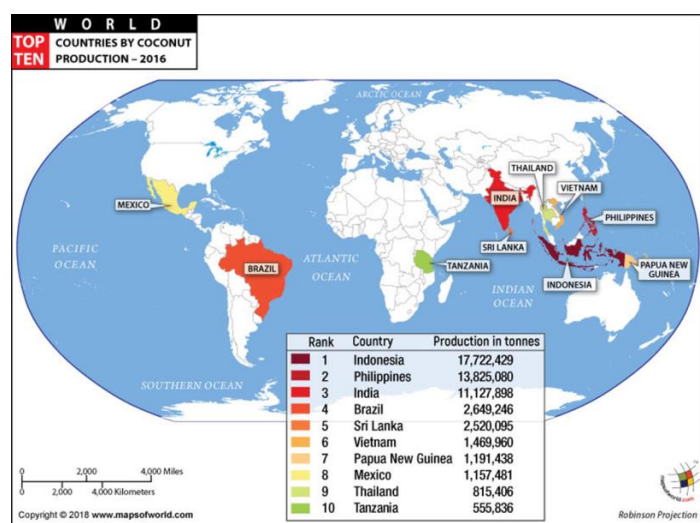


Fig: 1. World Production

According to Mohandas K Gandhi 3.5.1939 “The juice of coconut tree can be transformed into a sugar as soft as honey. Nature created this product such that it could not be processed in factories. Palm sugar can only be produced in palm tree habitats Local populations can easily turn nectar into coconut blossom sugar. It is a way to solve the world’s poverty. It is also an antidote against misery.”

Table 1: Scientific classification

Kingdom	Plantae
Sub kingdom	Tracheobionta
Super division	Spermatophyta
Division	Magnoliophyta
Class	Liliopsida
Subclass	Arecidae
Order	Arecales
Family	Arecaceae – Palm family
Genus	<i>Cocos</i> L. – coconut palm P
Species	<i>Cocosnucifera</i> L. – coconut palm P

## Coconut inflorescence sap (Neera)

Neera is the oyster white coloured, sweet, vascular sap collected by tapping the immature unopened spadix or inflorescence of coconut, is translucent, high in nutritional value and susceptible to natural fermentation at ambient temperature within a few hours of extraction.

- ❖ It is widely consumed in India, Sri Lanka, Africa, Malaysia, Indonesia, Thailand, and Myanmar.
- ❖ It is a delicious and nutritious drink rich in carbohydrates with sources of minerals, vitamins, proteins etc and nearly neutral pH.
- ❖ . The coconut palm trees start giving sap in the last week of March or the first week of April.
- ❖ At the reproductive phase, a coconut tree develops bunches of male and female flowers that are kept inside in a protective coat safely, called spadix, until it blossoms for reproduction.
- ❖ Technically, the sweet sap oozed out during tapping from the spadix has two nutritional status:
  - (i) Fermented sap with 5–8% alcohol called sweet toddy and
  - (ii) non-fermented sap named Neera with zero alcohol.

Neera tapped from the coconut inflorescence & is filtered, pasteurized and bio preservatives added to preserve the product.

### Tapping techniques

Selection of inflorescence and preparation Coconut trees can be tapped at an early age as soon as they attain yield stability. The unopened inflorescence is used for tapping. The development of female flowers inside the spathe (about 60 cm long) causes a swelling at the base, the appearance of which is taken as the appropriate stage for tapping. The inflorescence selected for tapping is tied around with a strong coir or plastic rope to prevent it from bursting.

### Tapping frequency

Tapping is done twice a day, in the morning and evening. Each time 1–2 mm spadix is sliced and it can be tapped in this way for 40–45 days depending on the tapper's skill, seasonal conditions and nature of the palm. A single spadix can be tapped until it is reduced to a stump of about 10–15 cm length.

### Sap yield

On an average a spadix can produce 1.5–3 litres of sap per day or 60–80 litres in a span of 40–45 days. Changes in pH and sugar content of fresh sap. Fresh sap has slightly alkaline pH (7.5–8, minor variation from tree to tree). pH of the completely fermented sap is around 3.5. The sap stored in a deep freezer (–2°C to –1°C) re-mains fresh and no change in pH was observed. Fresh sap (pH 7.5) has around 15% sugars.

### Hi-tech neera collection

- ❖ Neera tapping requires adherence to strict procedures right from selection of the inflorescence to collection of the first drop.
- ❖ In order to collect fresh, hygienic and unfermented sap CPCRI has developed a simple Coco-sap Chiller.
- ❖ Technologies have been developed by institutions like KAU, CFTRI and DFRL for arresting the fermentation process.
- ❖ The collected Neera is then subjected to filtration, refrigeration, centrifuging, processing and packaging.
- ❖ The processed product has a shelf life up to one year.

### Spray Drying of Unfermented Coconut Sap or Sweet Toddy into An Amorphous Powder

- Study was carried out to convert unfermented coconut sap or the sweet toddy into powder form through spray drying using maltodextrin (DE 10) as the drying aid with three different formulations of sweet toddy: maltodextrin (70%: 30%, 80%: 20% and 90%:10%)
- The best powder recovery ( $56.35 \pm 2.90\%$ ) was obtained for the formulation of sweet toddy: maltodextrin in the ratio of 80%:20%.
- It was interesting to note that both the moisture content and the water activity of sweet toddy powder did not vary significantly ( $p > 0.05$ ) on storage of one year.
- The sugar profile of this sweet toddy powder showed that it had a total sugar content of  $66.1 \pm 0.04\%$  out of which  $32.7 \pm 0.02\%$  was sucrose,  $22.4 \pm 0.01\%$  was glucose and  $11.0 \pm 0.01\%$  was fructose.

**Table 2: Biochemical and mineral composition**

Biochemical parameters	Range	Average
pH	6.57–7.50	7.18
Total sugar (g)	10.08–16.50	15.18
Reducing sugar (g)	0.439–0.647	0.554
Amino acids (g)	0.123–0.338	0.245
Protein (g)	0.150–0.177	0.165
Sodium (mg)	69.4–117.5	90.6
Potassium (mg)	146.1–182.4	168.4
Phosphorus (mg)	2.0–6.4	3.9
Manganese (mg)	0.009–0.014	0.012
Copper (mg)	0.028–0.035	0.031
Zinc (mg)	0.018–0.026	0.020
Iron (mg)	0.049–0.058	0.053
Phenolics (mg)	4.80–5.40	5.10
Antioxidant activity (m MTE)	0.299–0.355	0.321

### Antioxidant Properties of Coconut Sap and its Sugars

- The antioxidant properties of coconut sap were analyzed for which studies were conducted on the reducing power, levels of ascorbic acid, polyphenol content and alpha amylase inhibitory activity.

- Polyphenols and ascorbic acid are very good antioxidants and possess free radical scavenging activity and thereby exhibit good reducing power.
- Alpha amylase inhibitors cause delay in the digestion of carbohydrates, therefore causing reduction in the rate of glucose absorption. Sugar extract exhibited 45% inhibition of porcine pancreatic  $\alpha$  - amylase at 500  $\mu$ l and therefore may possess antidiabetic activity.

**Table 3: Vitamin content in freshly collected coconut sap**

Vitamin	Value (mg/100 ml)
Thiamine	77.00
Riboflavin	12.20
Pyridoxal	38.40
Pantothenic acid	5.20
Nicotinic acid	40.60
Biotin	0.17
Folic acid	0.24
Inositol	127.70
Choline	9.00
Vitamin B12	Trace
Vitamin C	17.5

#### Uses of neera

- ❖ *Neera* can be promoted as an instant energy provider, as a functional food or nutraceutical drink
- ❖ It is good for digestion, facilitates clear urination and prevents jaundice.
- ❖ The nutrient-rich "sap" has low Glycemic Index (GI of only 35) and hence diabetic-friendly since very low amounts of the sugar is absorbed into the blood.
- ❖ It is an abundant source of minerals, 17 amino acids, vitamin C, broad-spectrum B vitamins, and has a nearly neutral pH.
- ❖ It is good for persons in post-operative care due to a high content of electrolytes
- ❖ It is a body cooler and is good for digestion and with no side effects
- ❖ It can be used as an ideal sweetener & can fetch much better returns compared to copra



**Fig: 2 Value added products from Neera**

#### Future scopes

- ❖ Globally, *Neera* and its value-added products are being manufactured by all the major coconut producing countries except India.
- ❖ The major players in the field are Indonesia, Philippines, Thailand, Malaysia, Sri Lanka and Vietnam.
- ❖ The major export destinations are USA, Canada, Norway, France, Middle East, South Korea, Japan, Australia and New Zealand. MT in 2012.
- ❖ While it is a matter of pride that India leads the world in production and productivity of coconut ahead of Indonesia and Philippines, countries like Sri Lanka and Malaysia which are far behind us in coconut production, have already ventured into production of *Neera* and palm sugar.
- ❖ Considering the above fact, the scope for a tapping of Coco sap *Neera* may also be explored in the coconut growing North Eastern states like West Bengal, Assam, Bihar, Odisha, and other adjoining states which may reflect on the state GSDP b

#### Protective and Curative effect of CSP(Neera)

- Powerful ROS scavenging activity
- Protective role against ox-LDL induced oxidative stress and inflammation in hPBMCs.
- Hepatoprotective effect on alcoholic liver diseases
- Nephroprotective effect in nephrotoxicity
- Anti-hypertensive potential effect





Fig: 3 Marketed products of Neera

### ROS scavenging activity

- ROS - significant damage to cell structures due to its unpaired valence shell electrons.
- Chemiluminescent techniques are widely used for detecting and quantifying ROS through chemiluminescent reagents, such as luminol and lucigenin.
- coconut saps possess antioxidant activity and the health effects of coconut sap might be attributed to their ROS scavenging activity and DNA protecting effect.

### ox-LDL induced oxidative stress and inflammation in hPBMCs

Oxidation of low-density lipoproteins (LDL) is considered as an important marker of inflammation. Atherosclerosis is a chronic inflammatory disorder of the arterial vessel wall, initiated by the accumulation of lipoproteins in the intimal layer of the vascular wall. Accumulated oxidized lipids increase the expressions of genes in transcription factors like nuclear factor  $\kappa$ B (NF- $\kappa$ B) to induce chronic inflammatory condition. The toll-like receptor-4 (TLR4) plays a crucial role in the cell response to ox-LDL exposure and NF- $\kappa$ B activation is an early step in the downstream regulation of TLRs and advancing the vascular adhesion and activation of inflammatory cells (VCAM-1) Diet rich in natural antioxidants, vitamins, and minerals reduce the incidence of ROS mediated cellular damage and many inflammatory diseases

### Alcoholic liver diseases

- Pathogenesis of alcohol-induced liver diseases includes hepatocellular injury, fat accumulation, and liver inflammation leading to even liver cirrhosis
- Affect the functionality of the endogenous antioxidant defense systems
- Enhanced lipid peroxidation and significant elevation in the liver function marker enzymes
- Activate the Kupffer cells and activation of TNF- $\alpha$  stimulates NF- $\kappa$ B,
- MMP-2 and MMP-9 are the important matrix proteins involved in liver fibrosis.
- Current drugs were found to impose significant side effects.
- Safe natural agents
- Safe botanical agents are of great significance

### Nephrotoxicity

- Kidneys are essential for maintaining many aspects of metabolic homeostasis.
- Renal failure - disturbs overall chemical balance of the body.
- Gentamicin remains the most preferred aminoglycoside antibiotic for treatment of many severe bacterial infections (mainly Streptococcal infections).
- Nephrotoxicity induced by gentamicin is clinically known as a non-oliguric renal failure with characterized change in serum creatinine levels and a hyperosmolar urinary output.
- The drug may accumulate in epithelial tubular cells causing a range of effects starting with loss of the brush border in epithelial cells and ending in overt tubular necrosis, activation of apoptosis and massive proteolysis
- Aminoglycoside induced nephrotoxicity
- Herbal medicines

### Hypertension

- Hypertension is an important public health challenge worldwide
- Hypertension is defined as having a systolic blood pressure (SBP) of  $\geq 140$  mmHg and a

diastolic blood pressure (DBP) of  $\geq 90$  mmHg ( $\geq 140/\geq 90$  mmHg).

- Every 20/10 (SBP/DBP) mmHg increase indicates a higher risk stage of hypertension; stage 1 (140–159/90–99 mmHg), stage 2 ( $\geq 160/\geq 100$  mmHg) requiring immediate medical attention.
- Hypertension is often called the "silent killer"
- The treatment for hypertension includes antihypertensive drugs which helps in vasodilation
- Plants contain a bounty of phytochemicals that have proven to be protective by reducing the risk of various ailments and diseases

## Conclusion

The sweet, oyster white and translucent sap from the unopened inflorescence of coconut trees is a nutritious natural drink rich in carbohydrates, minerals, vitamins, and amino acids with a low glycemic index. The antioxidant activity might be attributed to their ROS scavenging activity and DNA protecting effect. CSP played a protective role against ox-LDL induced oxidative stress, chronic alcohol induced hepatic damage, gentamicin induced kidney toxicity and also found to be effective in the management of hypertension.

\* \* \* \* \*