



## HEALTH BENEFITS OF TENDER COCONUT WATER (TCW)

Siti Thomas Zulaikhah

Department of Public Health, Faculty of Medicine, UNISSULA, Semarang, Central Java, Indonesia

### Keywords:

TCW, GPx, L-arginine,  
Review

### Correspondence to Author:

**Siti Thomas Zulaikhah**

Department of Public Health, Faculty  
of Medicine, UNISSULA, Semarang,  
Central Java, Indonesia

**E-mail:** [sitithomas@unissula.ac.id](mailto:sitithomas@unissula.ac.id)

**ABSTRACT:** This review summarizes the health benefits of Tender Coconut Water (TCW). TCW is a natural, healthy, nutritious drink from coconut tree widely grown in tropical countries. Indonesia is the larger country with the largest coconut growing country in the world. The active compounds in TCW include methionine, L-arginine, cytokines, selenium, vitamin C, and Zn, Mn and Cu. L-arginine is present in TCW Significantly reduce the free radical generation, TCW Also contain vitamin C that Significantly reduce lipid peroxidation when Introduced in rats. L-arginine was able to increase glutathione peroxidase (GPx) activity in rat exposed to Plumbum. Cytokinin is a potent antioxidant against free radical-induced cell damage. Selenium is one of the micronutrients that form the enzyme GPx. Methionine is an amino acid containing sulfur that can be used as a source of thiols and plays a role in the synthesis of glutathione. The TCW of 5-7 months of age is about 500-750 mL; depending on the maturity and varieties of coconut. The older the coconut, the less water it contains

**INTRODUCTION:** Foods containing natural antioxidants can be used as a strategy to reduce morbidity and mortality especially due to oxidative stress<sup>1</sup> and the prevalence of degenerative diseases.<sup>2</sup> Coconut water is a natural, healthy, nutritious drink from coconut palm trees widely grown in tropical countries. Indonesia is the largest coconut growing country in the world.<sup>3</sup> TCW has a therapeutic effect,<sup>4,5</sup> containing various nutrients such as minerals, vitamins, antioxidants, amino acids, enzymes and growth hormones.<sup>6</sup> Recent studies have shown that TCW is rich in L-arginine, a free form amino acid, and vitamin C, which can prevent heart disease and lipid peroxidation.<sup>4,7</sup> In addition, TCW also contains various important compounds for the body, such as magnesium, potassium, calcium, selenium, methionine, zinc, iodine, manganese, boron, molybdenum and phytohormon such as auxin, cytokines, gibberellins.<sup>4,8</sup> L-arginine can be used for the therapy and reduce the effects of heavy metal poisoning.<sup>9</sup> Treatment with L-arginine was able to increase GPx activity in mice exposed to Plumbum (Pb).<sup>10</sup> Cytokinin is a potent antioxidant against free radical induced cell damage.<sup>8</sup> Selenium is one of the micronutrients that form the GPx enzyme. Methionine is an amino acid containing

sulfur that can be used as a source of thiols and plays a role in the synthesis of glutathione. Water content in a tender coconut of 5-7 months of age is about 500-750 mL, and depends on the maturity and varieties of coconut.<sup>11,12</sup>

The finding of Bhagya *et al.*<sup>4</sup> proved that tender coconut water can reduce oxidative stress and improve antioxidant status characterized by decreased MDA levels, increased levels of antioxidant enzymes such as SOD, CAT and GPx in mice fed fructose diet. Loki and Rajamohan showed that TCW has a beneficial effect, significantly lowering MDA levels and increasing levels of antioxidant enzymes such as SOD, CAT and GPx in carbon tetrachloride-induced rats (CCl<sub>4</sub>).<sup>13</sup> Similar research conducted by Anurag and Rajamohan<sup>34</sup> proved that tender coconut water improves mitochondria and provides protection against isoproterenol (free radical) induced damage. Zulaikhah *et al.* study showed that TCW can lower total cholesterol (TC), low-density lipoprotein (LDL) and triglycerides (TG) levels and decrease height-density lipoprotein (HDL).<sup>14</sup> The results of subsequent studies in human demonstrated that TCW can increase the antioxidant enzyme superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx), decrease lipid

peroxidation, and prevent oxidative stress in the traditional gold miners exposed to mercury.<sup>15</sup>

#### A. Type (Varieties) of Coconut

There are distinct varieties of coconut, but in general, it can be divided into two groups namely:

- a. Dwarf Coconut is a variety of coconut that yield nuts after 4-6 years of planting for example examples ivory coconut (Eburnia variety), coconut king (Regia), and king malabar (Pretiosa) and quail (Pumila).
- b. The deep coconut is a new coconut that yield fruit after reaching the age of 15 years after planting, the height of the tree can reach 30 meters for examples green coconut (Viridis ), red coconut (Rubescens)

Hybrids are the inter varietal crosses between dwarf deep coconut.

#### B. Coconut morphology<sup>11,12</sup>

Coconut trees can grow up to  $\pm 30$  m and live for 70 years. Coconuts grow in clusters and usually 1 side bunches 5 to 12 pieces. An adult coconut tree usually produces a new cluster every month or about 12 bunches per year. A productive coconut tree can produce 100-140 coconuts per year.<sup>31</sup>

Coconut (*Cocos nucifera* Linn), shaped like an egg or ellipse, varies in size, There are several varieties, different varieties have slightly different flavors. It consists of a network of fibrous outer layers called coconut husk (mesocarp) that covers a hard layer called a shell (endocarp). In the shell there is a nucleus (endosperm) which is believed to be the most important part of the coconut. Below are examples of morphology of types of green coconut (*vidity Viridis*) of ordinary type and 'wulung'



Figure 1. Wulung Green Coconut

t



Figure 2. Ordinary Green Coconut

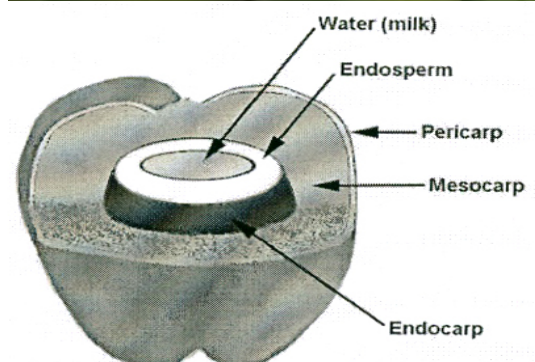


Figure 3. Morphology of coconut<sup>11,12</sup>

The nutrition, taste, size, texture, water and coconut flesh depend on coconut varieties and fruit maturity level, to achieve maximum maturity level takes between 12 - 13 months. After 6-7 months, coconut has a soft, thin, jelly-like meat (endosperm) and can be eaten with a spoon. At the age of 10-12 months it is referred to as mature coconut where the amount of water becomes reduced by about 15-30% from the weight of the fruit or about 300 mL, has a layer of hard and thick meat, and the taste becomes less sweet.<sup>11,12</sup> Growth of coconut fruit based on age 2 is presented in figure 2.

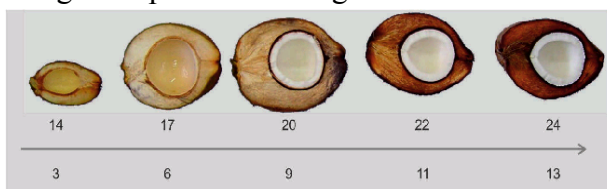


Figure 4. Coconut growth based on age<sup>16</sup>

TCW is called the “fluid of life”, referred to as the Coconut Water Tender (TCW), where tender means soft flesh like jelly.<sup>11</sup> The total water and sugar content reaches a maximum when the coconut is between 6-7 months of age, at this age coconut water has the sweetest and delicious taste. The content of water and sugar will be reduced with increasing age of coconut maturity.<sup>11,12,16</sup>

TCW is the most nutritious healthy drink from palm tree, is a natural isotonic drink that has content similar to our body's blood plasma.<sup>11</sup> The content of macro and micro nutrients found in tender coconut water can lower lipids, protect the heart and liver.<sup>17,18</sup> The content of nutrients of TCW is influenced by the age of fruit maturity, soil nutrient content and environmental conditions.<sup>12</sup>

C. TCW’s Composition

The measurement of the composition of TCW identified by Laboratorium Penelitian

dan Pengujian Terpadu (LPPT) and the chemical laboratory MIPA of Universitas Gajah Mada Yogyakarta with KLT and HPLC method. Examined the type of coconut water is the ordinary green coconut water and green coconut water wulung (Viridis variety) in range 5 to 7 months, where coconut water is commonly called coconut water (coconut milk tender).

Tabel 1. Coconut water composition ( Viridis Varies )

Component Components	Type of Green Coconut(Viridis)	
	Wulung	Ordinary
Vitamin C (Ascorbit Acid) (mg / L)	32.50	32.50
Amino acid (µg/mL)		
- L- Aspartic	115.60	30.81
- L-Glutamic	56.65	28.90
- L- Glutamine	<0.05	6.32
- L-Threonine	25.15	13.40
- L-Glycine	19.01	16.08
- L-Arginine	12.68	12.63
- L-Alanine	22.18	22.97
- L-Tyrosine	23.57	9.95
- L-Thryptophan+ L-Methionine	<0.13	235.22
- L-Valine	13.27	11.83
- L-Phenylalanine	12.68	8.80
- L-Isoleucine	10.10	11.48
- L-Leucine-	19.61	17.80
- L-Lycine-	23.77	26.22
- L-Histidine+ Serine	47.34	26.41
Mineral (mg/Kg)		
- Cu (Cuprum)	<0.02	0.40
- Fe (Iron)	6.00	0.39
- Mg (Magnesium)	146.16	74.24
- Mn (Mangan)	0.23	2.50
- Zn (Zink)	2.20	0.83
- Na (Natrium)	560.03	24.22
- K (Potassium)	6.31	2908.46
- P (Phospor)	8.76	94.43

Source: LPPT and Chemical Laboratory of MIPA UGM

D. Health Benefits of TCW for Health  
1. Natural Isotonic Drinks

High potassium in coconut water is necessary in maintaining osmotic pressure inside and outside the cell. The living cell membrane is a semi permeable membrane. When a cell is placed in a solution with a higher osmotic pressure (hypertonic), then the water in the cell will come out so that the cell is wrinkled and this process is called plasmolysis. In contrast, if the cell is placed in a solution of lower osmotic pressure (hypotonic), then the water from outside will enter the cell and will cause the cell to swell and this process is called plasmoptysis.<sup>19</sup> To keep the cells from being lay sided the osmotic pressure must be the same or isotonic. Coconut water called "water of life" invarious place in the world because efficacy treatment. Coconut water is called a natural isotonic drink because of the electrolyte content such as sodium and potassium contained in it.<sup>11</sup> TCW can be used as ready to drink food product having natural health beneficial nutrients.<sup>20</sup>

## 2. Prevents oxidative stress

According to Bhagya *et al.* TCW can reduce systolic pressure, lower triglyceride and free fatty acids. Mice with fructose diet treated with TCW reduced MDA levels as a parameter of lipid peroxidation, and increased antioxidant enzyme activity. The conclusions of this study indicate that tender coconut water therapy can effectively reduce the occurrence of oxidative stress and improve the antioxidant status in mice fed fructose diet.<sup>4</sup> Prathapan & Rajamohan showed that TCW significantly reduced the oxidative stress induced by isoproterenol (ISO) and exerted significant antithrombotic effects.<sup>7</sup> Anurag<sup>21</sup> showed that tender coconut water has a positive effect on mitochondrial activity and protects cells from free radical damage in isoproterenol-induced mice.<sup>21</sup> TCW is a rich of L-arginine and vitamin C. Free radical generation can be reduced due to L-arginine, vitamin C acts as a powerful antioxidant to peroxidative tissue

damage. L-arginine can inhibit the generation of ROS and lipid peroxidation.<sup>4</sup> Loki & Rajamohan reported that tender coconut water was able to lower levels of MDA and increase antioxidant enzymes SOD, CAT, GPx, in CCl<sub>4</sub>-induced rats.<sup>13</sup> Zulaikhah & Sampurna proves that tender coconut water can prevent oxidative stress due to mercury exposure the traditional gold miners.<sup>22</sup>

## 3. Antioxidant Activity

TCW is able to increase levels of antioxidant enzymes; Muhammad *et al.* reported that Coconut water vinegar has helped to attenuate acetaminophen-induced liver damage by restoring antioxidant activity and suppression of inflammation.<sup>13</sup> The study of Zulaikhah *et al.*, proved that the administration of TCW 450 mL/day for 30 days increased SOD and GPx levels in traditional gold miners exposed to mercury.<sup>15</sup> Agbafar *et al.* study stated that coconut water is able to increase the levels of SOD and GPx.<sup>23</sup> Some evidence points toward an antioxidant action of coconut water. Thus, administering coconut water (6 mL/100 g of body weight) to female rats intoxicated with carbon tetrachloride recovered the action of antioxidant enzymes SOD and CAT (catalase) levels and decreased lipid peroxidation. Coconut water is also rich in L-arginine, which significantly reduces the generation of free radicals and has antioxidant activity, as well as ascorbic acid, which decreases lipid peroxidation in rats.<sup>29</sup>

## 4. Lipid peroxidation Activity (Reduces MDA levels)

Signs of lipid peroxidation include MDA levels. The content of organic and inorganic ions in tender coconut water plays an important role in the antioxidant system of the human body can normalize cell function, increase antioxidant activity, increase bone formation, increase hemoglobin, gene expression, amino acid metabolism, fat and

carbohydrate.<sup>12</sup> TCW can also be used to protect the heart and prevent peroxidation.<sup>4,7</sup> Zulaikhah *et al.* proved that the administration of 450 mL/day of TCW 30 days lowers MDA levels in traditional gold miners exposed to mercury.<sup>15</sup> Loki & Rajamohan reported that TCW was able to decrease MDA levels in CCl<sub>4</sub>-induced rats.<sup>13</sup> Agbafar *et al.* studies suggest that coconut water is capable of lowering MDA levels as lipid peroxidation markers.<sup>23</sup> Lima *et al.* Show administering coconut water (6 mL/100 g of body weight) to female rats intoxicated with carbon tetrachloride recovered the action of decreased lipid peroxidation.<sup>29</sup>

#### 5. Improve Lipid Profile

According to Bhagya *et al.* tender coconut water lower triglycerid and free fatty acids.<sup>4</sup> is supported by Zulaikhah *et al.* showing that TCW lower total cholesterol, triglyceride levels, LDL levels and increase HDL levels.<sup>14</sup> The findings of Agbafar *et al.*, showed that coconut water is able to reduce total cholesterol, triglycerides and LDL and can reduce HDL.<sup>23</sup> TCW could also reduce total cholesterol, LDL, and triglyceride levels in serum. Administering coconut water (4 mL/100 g body weight) in male rats counteracted the increases in these substances promoted by cholesterol feeding.<sup>29</sup>

#### 6. Improve Blood Pressure

According to Bhagya *et al.* TCW can lower systolic pressure.<sup>4</sup> The finding of Farapti *et al.* proved that fresh tender coconut water 300 ml administered twice a day for 14 consecutive days to lower systolic blood pressure, but not the diastolic blood pressure.<sup>24</sup> TCW is useful for preventing dehydration, reducing swelling in the hands and feet, protecting against cancer, helping the blood sugar balance of diabetics, providing ionic mineral resources, increasing digestion, helping to relieve constipation, reducing the

risk of heart disease, improving blood circulation, lowering blood pressure high, helps prevent atherosclerosis, prevents abnormal blood clotting, has anti-aging properties, restores strength and elasticity to the skin, reduces wrinkles and sagging skin, as an antioxidant, enhances immune function.<sup>8,11,25</sup> Research Gullapalli *et al.* states that the consumption of the coconut water is decreased in the blood pressure in primary hypertensive patients. The systolic and diastolic blood pressure (BP) of experimental group decreased by 10.5 mm Hg and 6.8 mm Hg respectively.<sup>26</sup>

#### 7. Cardioprotective activity

Epidemiological studies suggest that high levels of HDL can prevent heart disease (cardiovascular diseases) such as ischemic stroke, myocardial infarction.<sup>23</sup> Anurag and Rajamohan showed that coconut water has cardioprotective effect in experimental myocardial infarction induced in rats.<sup>18</sup> An important biological action of coconut was demonstrated using an experimental model of myocardial infarction induced by isoproterenol in rats. Feeding these animals with TCW protected against the induction of myocardial infarction and decreased mitochondrial lipid peroxidation.<sup>29</sup>

#### 8. Anti-inflammatory effects

The anti-nociceptive and anti-inflammatory effects observed in this study, like other biological properties of coconut water, may be due to its unique composition of sugars, vitamins, minerals, amino acids and cytokinin acids. This reduces threshold in both lactating and adult rats. This anti-inflammatory potential of coconut water may be linked descriptively with inhibiting prostaglandin production, thereby reducing inflammation and pain. The results of the study show that coconut water possesses analgesic and anti-inflammatory properties in aduration-dependent manner. The analgesic property was demonstrated on the basis of thermal nociception in the test models of hot plate and tail immersion, and chemical

nociception in formalin-induced paw licking and acetic acid induced writhing tests. Anti-inflammatory effect was evaluated using the same test model of carrageenan-induced paw edema. Coconut water is able to prevent inflammation.<sup>27</sup>

#### 9. Diarrhea Therapy

Coconut water is rich enzyme systems include very effective and selective reductase, polyphenol oxidase (PPO) and peroxidase (POD). These are involved in its development of a brownish color when it is exposed to air for a long time. Based on its content and properties, coconut water has been used in the treatment of child and adult diarrhea, and gastroenteritis as well as for urinary stone dissolution, short-term intravenous hydration and protecting against gastrointestinal tract infections.<sup>28</sup>

#### 10. Antidiabetic activities

The effects of mature coconut water were also evaluated and compared with glibenclamide in alloxan-induced diabetic rats. Treatment of diabetic rats with lyophilized mature coconut water (1000 mg/kg body weight) or glibenclamide (0.6 mg/kg body weight) reduced blood glucose levels (129.23±1.95 and 120±2.3 mg/dL, respectively) when compared with the untreated control (275.32±4.25 mg/dL). Coconut water also increased insulin levels and liver glycogen concentrations and reduced glycated hemoglobin levels in diabetic rats. In addition, elevated levels of liver function enzymes markers like alkaline phosphatase, serum glutamate oxaloacetate transaminase, and serum glutamate pyruvate transaminase in diabetic rats were significantly reduced upon treatment with mature coconut water. It was also observed that diabetic rats showed altered levels of blood urea, serum creatinine, and albumin, and the albumin/globulin ratio was significantly reversed by treatment with mature coconut water and glibenclamide.<sup>29</sup>

#### 11. Increase hemoglobin levels

Tender coconut water is effective to reduce the parasitaemia index and increase hemoglobin levels in mice inoculated Swiss PBA, but effect in human malaria is not confirmed and need further investigation.<sup>30</sup>

#### Another benefits

The Coconut Development Board (CDB) states that TCW can be utilized to:

- a. Feeding baby with intestinal disorders,
- b. Oral rehydration,
- c. Preventing body chillness
- d. Preventing prickly heat, eliminating rash caused by chicken pox, measles etc.
- e. Killing the worms,
- f. Good drinks in case of cholera,
- g. Diuretics,
- h. Treating kidney and urethral stones,
- i. Preventing urinary tract infections,
- j. Intravenous injection in case of emergency,
- k. Detoxification toxins in cases of poisoning,
- l. A tonic for the elderly and the sick, and
- m. Urinary tract antiseptics.<sup>12</sup>

TCW contains an electrolyte fluid that maintains the body's osmotic pressure, can be used as an intravenous fluid in an emergency. In case of emergency in remote regions of the world and during World War II, coconut water was used as a short-term intravenous hydration and resuscitation fluid,<sup>27</sup> TCW was used as a substitute for fluids and nutrients at the time of the babies suffering from diarrhea in Vietnam.<sup>11</sup>

#### CONCLUSION

Experimental studies involving human and animals showed that TCW can be used to prevent oxidative stress, Antioxidant activity, Lipid peroxidation Activity, Improve Lipid Profile, Blood Pressure, Cardioprotective

activity, Anti-inflammatory effects, Diarrhea Therapy, Increase hemoglobin levels, Antidiabetic activities and Antithrombotic Activities etc.

#### ACKNOWLEDGEMENTS

This article was supported by Faculty of Medicine UNISSULA Semarang.

#### CONFLICT OF INTEREST

The Authors declared no conflict of interest

#### REFERENCES

1. Winarsi H. Antioksidan Alami & Radikal Bebas. Yogyakarta: Kanisius; 3 ed. 2007.
2. Astuti S. Isoflavon Kedelai dan Potensinya sebagai Penangkap Radikal Bebas. Jurnal Teknologi Industri dan Hasil Pertanian. 2008;13:126-36
3. Kemendustrian RI. Roadmap Industri Pengolahan Kelapa Direktorat Jenderal Industri Agro. In: Perindustrian K, editor. Jakarta;2010.
4. Bhagya D, Prema L, Rajamohan T. Therapeutik Effects of Tender Coconut water on Oxidative Stress in fructosa fed Insulin Resistant Hypertensive Rats. Asian Pasific Journal of Tropical Medicine. 2012;270-6.
5. Medeiros VdFLDP, Medeios AC. Therapeutic use of coconut water. J Surg CI Res. 2012;3:75-83
6. Johnkennedy N, Joy D-N, Ndubueze EH, Melvina N, Richard E, Vitus O. Antioxidant and Cardioprotective Effect of Coconut Water against Doxorubicin Induced Cardiomyopathy. Journal of Krishna Institute of Medical Sciences University. 2013;2:37-41
7. Prathapan A., Rajamohan T., Antioxidant And Antithrombotic Activity Of Tender Coconut Water In Experimental Myocardial Infarction. Journal of Food Biochemistry. 2011; 35(5):1501-1507
8. Lukose RM. The Chemical Composition of Tender Coconut (*Cocos Nucifera L.*) Water and Coconut Meat and Their Biological Effect in Human Body. International Journal of Green and Herbal Chemistry. 2013;2(3):723-9
9. Kumar CA, Kumar KMU, Kumari KV, Rao R. L-Arginine Mitigates Heavy Metal Inhibited Nitric Oxida Synthase Activity in

Tissues of the Albino Rat. The Bioscan. 2013;8:937-9.

10. Tkachenko H, Kurhalyuk N. Role of L-Arginine Against lead Toxicity in Liver of Rats with Different Resistance to Hypoxia. Pol J Environ Stud. 2011;20(5):1319-25
11. Fife B. Coconut Water for Health and Healing. USA: Piccadily Books, Ltd; 2008.
12. Priya SR, Ramaswamy L. Tender Coconut Water-Natures Elixir to Mankind. International Journal of Recent Scientific Research. 2014;5(8):1485-90.
13. Muhammad NE. *et al.* Coconut water vinegar ameliorates recovery of acetaminophen induced liver damage in mice. BMC Complementary and Alternative Medicine. 2018; 18:195
14. Zulaikhah, S.T. , Danis P. , Bagus S.A , Nuri S , Brillian J.E.M , Alfiza N.S. Effect of tender coconut water on blood lipid levels in hight fat diet fed male rats. Journal of Krishna Institute of Medical Sciences University (JKIMSU). 2017; 6 (2): 63-68
15. Zulaikhah,S.T., Anies, Ari S., Santosa. Effects of Tender Coconut Water on Antioxidant Enzymatic Superoxida Dismutase (SOD), CATALASE (CAT), Glutathione Peroxidase (GPx) and Lipid Peroxidation In Mercury Exposure Workers. International Journal of Science and Research (IJSR). 2015; 4 (12): 517-524
16. Alexia P, Dornier M, Diop N, Pain J-P. Coconut Water Uses, Composition and properties : a review. Fruits. 2011;67:87-107.
17. Sandhya VG, Rajamohan T. Comparative Evaluation of the Hypolipidemic effect of coconut water and lovastatin in rats fed fat cholesterol enriched died. Food Chem Toxicol. 2008;46:3586-92.
18. Anurag P, Rajamohan T. Antioxidant and Antithrombotic Activity of Tender Coconut water in Axperimental Myocardinal Infarction. Journal of Food Biochemistry. 2011;35:1501-7.
19. Damin S. Pengantar Kimia: Buku Panduan Kuliah Mahasiswa Kedokteran dan Program Strata I Fakultas Bioeksakta. Jakarta: EGC; 2009.
20. Geetha V, Bhavana KP, Chetana R, Gopala Krishna AG and Suresh Kumar G. Studies on the Composition and In-Vitro Antioxidant

- Activities of Concentrates from Coconut Testa and Tender Coconut Water. *Journal of Food Processing & Technolog.* 2016; 7(5):1-5
21. Anurag P, Rajamohan T. Beneficial effect of tender coconut water against isoproterenol induced toxicity on heart mitochondrial activities in rats. *Indian Journal of Biochemistry and Biophysics.* 2003;40:278-80
  22. Zulaikhah ST., Sampurna S. Tender Coconut Water To Prevent Oxidative Stress Due To Mercury Exposure. *IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT).* 2016; 10(6): 35-38
  23. Agbafor, S. O. ELOM, M. E. Ogbanshi, A. O. OKO, A. J. Uraku, V. U. O. Nwankwo, B. A. Ale and K. I. OBIUDU. Antioxidant Property and Cardiovascular Effects of Coconut (*Cocos nucifera*) Water. *International Journal of Biochemistry Research & Review.* 2015; 5(4): 259-263
  24. Farapti, Savitri S , Parlindungan S. Effect of tender coconut water on systolic and diastolic blood pressure in prehypertensive women. *Health Science Indones.* 2013; 4 (2): 64-68
  25. Hedge BM. Coconut for Health & Health. *Indian Coconut Jurnal.* 2011;LIV:4-7.
  26. Gullapalli HS, Avinash P T, Namrata H G. Effect of supplementation of tender coconut water on blood pressure of primary hypertensive subjects. *International Journal of Medical Research & Health Sciences.* 2013; 2(2):172-176
  27. Ajeigbe KO, Ndaman ZA, Amegor OF, Onifade AA, Asuk AA, Ibronke GF and Olaleye SB. Anti-Nociceptive and Anti-Inflammatory Potential of Coconut Water (*Cocos Nucifera L.*) In Rats and Mice. *Australian Journal of Basic and Applied Sciences.* 2011; 5(9): 1116-1122
  28. Prabhakar R., Mohana L. Coconut Water - Properties, Uses, Nutritional Benefits in Health and Wealth and in Health and Disease: A Review. *Journal of Current trends in Clinical Medicine & laboratory biochemistry.* 2014; 2(2):6-18
  29. Lima E., Sausa C., Meneses L., Ximenes N., Junior MA., Vasconcelos G., Lima N., Patrocinio M., Macedo D., Vasconcelos S. *Cocos nucifera (L.) (Arecaceae): A phytochemical and pharmacological review.* *Brazilian Journal of Medical and Biological Research.* 2015; 48 (11): 953-964
  30. Mulyanti, Edi D., Kis D., Noor W. Effectiveness of tender coconut water (*cocos nucifera l*) against parasitemia index and hemoglobin levels in malaria infection. *International Journal of Pharmaceutical Sciences and Research.* 2016; 7(9): 3873-3876



