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EFFECTIVITY OF CINNAMON (*Cinnamomum burmanii*) TO DECREASE UREA LEVELS

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ABSTRAK

Ureum atau *Blood Urea Nitrogen* (BUN) merupakan zat nitrogen non-protein darah hasil proses katabolisme protein dan asam amino yang dibentuk di hati melalui siklus urea dan dieksresikan oleh ginjaldalam bentuk urin, keringat, dan mengalami penguraian oleh bakteri usus**.** BUN dapat mengindikasikan adanya gangguan pada ginjal. Kayu manis (*Cinnamomum burmanii*) merupakan tanaman asli Indonesia yang dapat berfungsi sebagai antiinflamasi dan antioksidan yang mampu menurunkan kadar ureum dan berperan terhadap perbaikan fungsi ginjal. Metode penelusuran dilakukan melalui *google scholar*, *Pubmed*, dan *Science Direct.* Kata kunci yang digunakan ialah "*cinnamomum burmannii*" "kayu manis""*cinnamon extract*" "*blood urea nitrogen*" "*serum urea*" "*urea*" "*ureum*" "*acute kidney injury*" "*coumarin*". Kayu manis yang mengandung senyawa Cinnamaldehyde, kumarin, tannin, flavonoid, polifenol, glikosida, terpenoid, dan antrakuinon mempunyai potensi untuk melindungi ginjal dengan penurunan kadar ureum dengan menurunkan stress oksidatif pada ginjal.

Kata kunci: *Cinnamomum burmanii,* ureum, ginjal

ABSTRACT

Urea or Blood Urea Nitrogen (BUN) is a non-protein blood nitrogen molecule that results from the catabolism of protein and amino acids through the urea cycle and is eliminated by the kidneys as urine, perspiration, and degraded by intestinal bacteria. BUN levels can indicate renal disease. Cinnamon (Cinnamomum burmanii) is an Indonesian herb that functions as an anti-inflammatory and antioxidant, reducing urea levels and contributing to improved kidney function. The search was conducted using Google Scholar, Pubmed, and Science Direct. "cinnamomum burmannii", "cinnamon", "cinnamon extract", "blood urea nitrogen", "serum urea", "urea", "ureum", and "kidney" were used as keywords. Cinnamon, which contains cinnamaldehyde, coumarins, tannins, flavonoids, polyphenols, glycosides, terpenoids, and anthraquinone compounds, might protect the kidneys by reducing urea levels through the decrease of oxidative stress

Keywords: *Cinnamomum burmanii,* urea, kidney

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1. INTRODUCTION

Kidneys are important organs in the metabolite system that function to get rid of metabolic waste that is not needed by the body, maintain acid-base balance, body fluids and electrolytes, stimulate red blood cell production and as a blood pressure regulator. Urea is a waste of protein metabolism that is primarily eliminated in the urine by the kidneys. Increased protein consumption, upper gastrointestinal hemorrhage, lack of blood flow to the kidneys, such as in dehydration or heart failure, and hypercatabolic conditions such as infection can cause an increase in blood urea levels.[1] An increase in blood urea levels may also indicate damage to the body's cells, particularly kidney cells. Calculating the glomerular filtration rate (GFR) using the parameters of urea (blood urea nitrogen/BUN) and creatinine in the blood is one method for diagnosing a kidney diseases.

Currently, many herbal plants have been developed to be used as alternative medicine, including cinnamon plants. Cinnamon (Cinnamomum burmannii) is one of the native plants of Indonesia which has long been widely known by the public as a cooking spice or as a raw material in traditional medicine. Cinnamon contains compounds, including cinnamaldehyde, coumarins, tannins, flavonoids, polyphenols, glycosides, terpenoids, and anthraquinones. Flavonoids and polyphenols as anti-inflammatory are used to repair body cells and treat various disease conditions. Cinnamaldehyde plays a role in reducing triglyceride cholesterol, blood glucose, HbA1C, and increasing insulin and high density lipoprotein (HDL). Flavonoids, polyphenols and cinnamaldehyde are known to have anti-inflammatory and antioxidant effects that can improve kidney function, one of which is by reducing levels of oxidative stress so that it can reduce the value of urea as a marker for improving kidney function. [2,3] Therefore, further research is required to determine the efficacy of *Cinnamomum burmannii* on renal function, particularly its ability to reduce blood urea levels.

2. METHOD

A search is conducted through Google Scholar, Pubmed, and Science Direct to find information. "cinnamomum burmannii", "cinnamon", "cinnamon extract", "blood urea nitrogen", "serum urea", "urea", "ureum", and "kidney" were the keywords utilized. Moreover, research, review articles, and literary studies published in Indonesian and English during the past decade are included.

3. RESULT AND DISCUSSION

3.1 Urea

Urea is a waste product of the breakdown of proteins in the body. The urea cycle (also known as the ornithine cycle) is a reaction that converts ammonia (NH_3) into urea ($CO(NH_2)_2$). In a steady-state nitrogen balance, approximately 25 mg of urea will be excreted daily. Most of these chemical reactions occur in the liver and to a lesser extent in the kidneys. The liver is the center for converting ammonia to urea related to the liver's function as a place to neutralize toxins. Urea is poisonous, thus its accumulation in the body can be dangerous. An elevated level of urea in the blood may indicate a renal disorder.[4]

Examination of blood urea levels, blood urea nitrogen (BUN), is a common measurement due to its simplicity and precision. Blood urea level will increase as protein consumption increases. Enhanced urea can also be produced by disease or kidney injury that causes BUN to build in the blood as a result of a decrease in the glomerular filtration rate, such as shock, heart failure, upper gastrointestinal bleeding, increased hypercatabolic

conditions such as infection, post-infection, postoperative and surgery, and taking certain medications.[5,6]

Urea is an excreted waste product of protein and amino acid metabolism. The amount of urea in the blood is determined by dietary protein and the ability of the kidneys to excrete urea. If the kidneys are injured, blood urea will accumulate. An increase in plasma urea indicates kidney failure in performing its filtering function. Uremia is the condition of renal failure marked by extremely high plasma urea levels. This condition is hazardous and necessitates hemodialysis or a kidney transplant.[7]

Cinnamon (Cinnamomum burmannii)

Cinnamon plants are from the family Lauraceae, genus Cinnamomum, and have four main species, namely C. verum (C. zeylanicumatau 'true cinnamon' often called Sri Lankan cinnamon or Ceylon), C. burmannii (also called Corinthian, Indonesian cinnamon), C. cassia (C.aromaticum, also called Chinese cinnamon), and C. loureiroi (also known as Vietnamese cinnamon or Saigon).[2] All parts of cinnamon, namely bark, branches, twigs and leaves contain beneficial phytochemicals. Cinnamon bark is widely commercialized and becomes one of the popular herbs used as a cooking spice. In addition, its processed products in the form of essential oils and oleoresins have been widely used in the pharmaceutical, cosmetic, food, beverage and cigarette industries, also used in traditional medicine.[8]

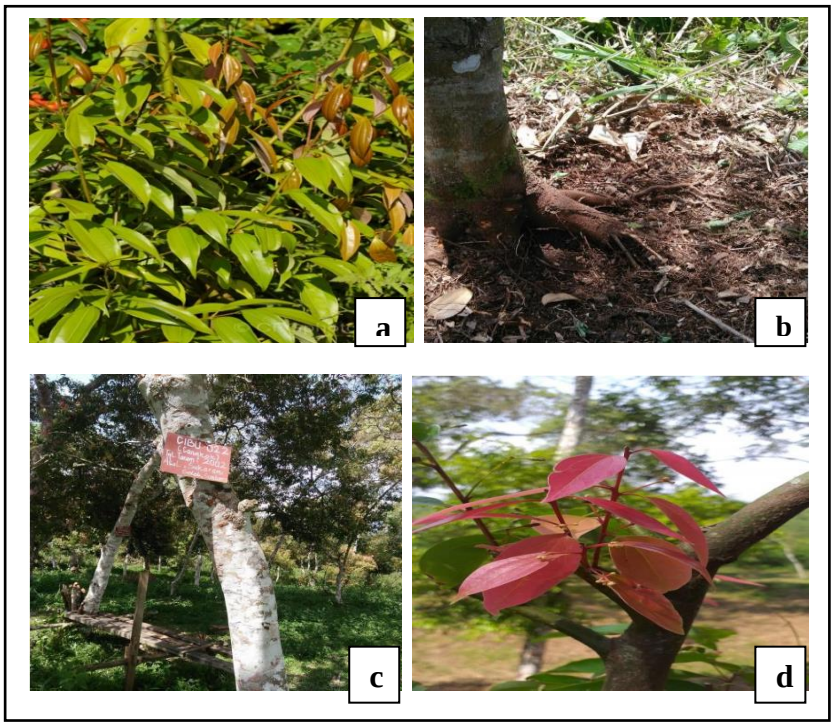

Figure 1. (a). Cinnamon (b). Cinnamon root
(c). Cinnamon rod (d.) Cinnamin leaves

Different types of cinnamon have different characteristics, such as C. verum has a delicate taste, C. cassia and C. loureiroi have a strong aroma and spicy-sweet taste. C. loureiroi has a stronger taste and a high content of synamaldehide and essential oils. C. burmannii has a high content of synamaldehide, but has a softer and less bitter taste than C. cassia and C.

loureiroi. The aromatic essential oils contained in cinnamon produce characteristic aromas and flavors. The higher the oil content, the stronger the taste.[2] Coumarin content is a key distinction between C. zeylanicum and C. cassia. The coumarin levels in C. zeylanicumc appear too low to pose a health risk, whereas the coumarin levels in C. cassia are substantially greater.[9]

Cinnamomum burmannii is a plant native to Indonesia that is widely found in West Sumatra, Jambi, North Sumatra, Bengkulu, West Java, Central Java, East Java and Maluku. Cinnamomum is rich in polyphenols that are natural antioxidants.[2] Some of the phenolic compounds in the essential oils of the four cinnamon species are synamaldehide, coumarin, proantosianin, catechin, epicatekin, prosianidin B1, proantosianidin as the main compound.10 The content of C. burmannii is mostly synamaldehide, inamate alcohol, anthosinin, eugenol, safrol, eucalyptol, tannins, calcium oxalate, and essential oils, as well as sugar, protein, fat, pectin content.[8,10]Phytochemical results of C. burmannii extract indicate the presence of flavonoids, phenolic compounds, and tannins. The results of qualitative analysis of C. burmannii extract show the presence of simple phenolic compounds, such as pyrocatechol, catechol, guaiacol, and hydroquinone which are suspected to be the result of decomposition of polyphenol group compounds and are suspected to be oral antidiabetic agents.[11] Sinamaldehida is an antioxidant compound with the ability to sweep free radicals.[12] Toxicity tests of C. burmannii extract with methanol (containing 0.07% and 0.20% (w/w) of coumarin and trans-synamaldehide, after 14 days and 28 days of oral administration with levels of 500, 1000, and 2000 mg/kg in Sprague-Dawley rats found the administration did not cause toxicity and mortality.[13] C. burmannii is known to have analgesic, antibacterial, antidiabetic, antifungal, antirheumatic, antithrombotic, and antitumor activity.[10,14]

Flavonoids are a group of polyphenol compounds. Flavonoids are known to have medicinal properties and have a major role in successful medical treatments in ancient times, and their use has survived to the present. Flavonoids are powerful antioxidants that dissolve in water and bind free radicals, which prevent oxidative cell damage and have a strong anti-cancer activity. They are used to improve aquaresis and as anti-inflammatory, antispasmodic and anti-allergic antimicrobial agents. Flavonoids also have biochemical effects, which inhibit some enzymes such as aldose reductase, xanthine oxidase, phosphodiesterase, ATPase, lipoxygenase, cyclooxygenase, etc. Flavonoids also have a role towards regulation on different hormones such as estrogen, androgens, and thyroid hormones. Flavonoids are known to have anti-inflammatory activity in both the proliferative and exudative phases of inflammation. In addition, flavonoids (quercetin) also have antioxidant activity so that they inhibit lipid peroxidation by dampening free radicals and increasing the concentration of intracellular glutathione. Antioxidants in flavonoids can occur through two pathways, namely the pathway that stops the propagation stage by stopping the chain reaction by donating electrons to the fatty acid radical peroxyl and the pathway that inhibits the activity of xanthine oxidase directly so that it can reduce oxidative damage.[15]

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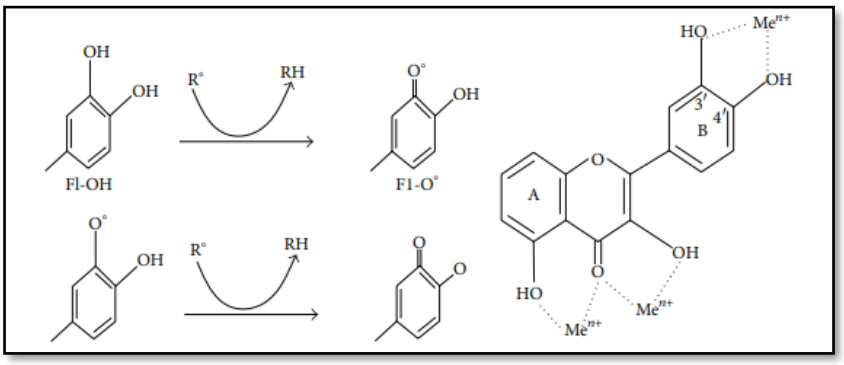

Figure 2. Chemical Reactions to Flavonoids

Cinnamaldehyde

Cinnamaldehyde acts as an antioxidant by inhibiting aldose reductase, an enzyme that plays a role in the polyol pathway, so that the formation of oxidative stress is inhibited. When cinnamon extract was added in the treatment group, there was an increase in the amount of antioxidants that have renal properties of protectors.[15]Studies have shown that the phenolic hydroxy group of synamaldehyde plays a very important role as an antidote to radicals (antioxidants). Cinnamaldehyde as an inhibitor of cytochrome P-450 is likely mediated by the presence of a hydroxy group.[12]The reaction of hydroxyl radicals (OH) with curcumin causes the phenolic hydrogen to be withdrawn, then the resulting phenolic radicals are solidified and react again with the phenolic radicals. In this way OH is neutralized, thus preventing the occurrence of lipid peroxidation in the mitochondrial membrane.[13]

Alkaloids

Alkaloids are heterocyclic nitrogen compounds. As a secondary metabolite, alkaloids play a defensive role in plants against herbivores and pathogens. Due to its powerful biological activity, about 12,000 alkaloids have been utilized as drugs, stimulants, narcotics and toxins. Alkaloid

group compounds have antioxidant properties by inhibiting the oxidation reaction of fatty acids such as linoleic acid so that the formation of free radical chains is inhibited and by means of proton donors to stabilize free radicals.[15]

Polyphenols

Polyphenols inhibit the formation of free radicals by giving hydrogen atomic donors with the mechanism of breaking the chain of radical formation and binding transition metal ions.[15]

Tanin

Tannins are divided into two groups, namely hydrolyzed tannins and condensed tannins. Tannins have a complex biological role ranging from protein-setters to metal chelates. Tannins can also function as biological antioxidants. Antioxidants in the chemical sense, are electron-giving compounds. Tannins work by donating one electron to an oxidant compound so that the activity of the oxidant compound can be inhibited. Tannins stabilize free radicals by

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supplementing the lack of electrons that free radicals have, and inhibit the occurrence of chain reactions from the formation of free radicals. [16]

Tannins are active compounds of secondary metabolites that are known to have several properties, namely as astringent, anti-diarrheal, anti-bacterial and antioxidant. Tannins are a very complex component of organic substances, consisting of phenolic compounds that are difficult to separate and difficult to crystallize, precipitating proteins from the solution and intersecting with these proteins. One of the methods used to test antioxidant activity is the 1,1-diphenyl-2-picrilhydrazyl (DPPH) method. The interaction of antioxidants with DPPH either by electron transfer or hydrogen radicals in DPPH, will neutralize the free radical character of DPPH and form a reduced DPPH. If all the electrons on the DPPH free radical become paired, then the color of the solution changes from dark purple to bright yellow and the absorbance at a wavelength of 517 nm will be lost.

Saponins

Saponins are also reported as free radical suppressors in the form of hydroxyls. Of the various secondary metabolites in the methanol extract of kesum leaves that act as antioxidants, but it is not certain which compounds are responsible for reducing urea and creatinine levels.[16]

Triterponoids

Triterpenoids show their antioxidant activity through inhibitory reactions of fatty acid oxidation reactions so that free radical chains can be inhibited.[16]

Cinnamomum burmannii decrease ureum levels

Kidney disease is based on cellular biochemical mechanisms in the form of free radicals that accidentally enter the inside including toxic substances, free radicals underlie cellular reactions to oxidative stress so that it plays an important role in the pathophysiology of various diseases, including diseases and impaired kidney function. One way to determine the presence of disorders in the kidneys is to calculate the glomerular filtration rate (LFG) using the parameters of the urea and creatinine in the blood.[5,6] Urea is a residual product of protein and amino acid metabolism that is excreted through the kidneys. The amount of urea in the blood is determined by the protein diet and the ability of the kidneys to excrete urea. Urea is a waste product of the breakdown of proteins in the body. Urea is toxic so that it can harm the body if it accumulates in the body. Increased urea in the blood can signal a disorder in the kidneys.[4]

Alkaloids, flavonoids, polyphenols, saponins, safrole, tannins, synamaldehide, and triterpenoids found in cinnamon extract have antioxidant and anti-inflammatory activities.. Cinnamaldehyde is also one of the main active components in cinnamon extract that can decrease the activity of the urea. In addition, the active polyphenol compounds from cinnamon in the form of cystids that act as antioxidants can reduce urea levels. The mechanism that plays a role is by suppressing oxidative stress from various oxidative reactions that occur in the kidneys. Chemical compounds such as alkaloids, flavonoids, synamaldehyde, tannins, polyphenols and saponins can inhibit the occurrence of lipid peroxide by preventing free radicals and increasing the concentration of intracellular antioxidants.[17,18]Flavonoids and phenols in cinnamon act as antioxidants that can inhibit or get rid of excessive amounts of free radicals so as to reduce the damage that occurs due to free radicals. In addition, flavonoids act as antioxidants and are able to protect DNA from free radicals.[18] Oxidative stress occurs due to an increase in free radicals. Free radicals can be prevented by providing antioxidant

compounds, namely flavonoids, alkaloids, tannins, and others found in cinnamon, so cinnamon can act as a renoprotector.[19]

4. CONCLUSION

Cinnamon contains flavonoids, cinnamaldehyde, alkaloids, tannins, saponins and polyphenols as antioxidants and anti-inflammatories that can be used to repair body cells and treat various conditions including as a therapeutic effect to protect the kidneys by lowering urea levels through reducing oxidative stress levels.

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