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The Potential of Mixed Tea from Mangosteen Pericarp, Clove, And Cinnamon in The Functional Scope of Creating a Healthy Liver Organ

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ABSTRACT

The liver, which is the largest organ in the intestinal tract can do several very complex jobs. The use of herbal teas that utilize plants with high antioxidant content is one strategy that is starting to attract interest. In tea form, a blend of mangosteen pericarp, cloves, and cinnamon can protect the liver from oxidative damage and inflammation. The purpose of this article is to explore, analyze, and summarize various theories about the potential of a mixture of mangosteen, cinnamon, and clove tea, hepatoprotective mechanisms, and liver health biomarkers in terms of antioxidant content. The writing method used is a literature review from international and national journals by tracing and summarizing several theories related to the topic and title of the article to be written, which ultimately develops new conclusions as broader and stronger theories. The results show that mangosteen peel, cloves and cinnamon have functional benefits, namely they can create a healthy liver because of their antioxidant content. Mangosteen peel contains quite high polyphenol antioxidants, including xanthones, phenolic acids, flavonoids, catechins, hexadecanoic acid, and oleic acid. Cloves contain the antioxidants eugenol, saponins, tannins, flavonoids, and polyphenols. Cinnamon contains phenolic antioxidants such as eugenol, cinamic aldehyde and beta caryophyllene Damage to cell membranes and proteins is a sign of oxidative stress caused by free radicals. Therefore, antioxidants are needed to convert free radicals into non-reactive compounds. Biomarkers of a healthy or damaged liver are through blood tests including levels of SGPT, SGOT, SGPT-SGOT, Gamma GT, albumin and globulin levels, bile acid levels, and bilirubin levels. In conclusion, tea mixed with mangosteen peel, cloves, and cinnamon contains high levels of antioxidants so it has the potential to protect against liver damage due to various oxidative stress factors.

Keywords: Mangosteen Pericarp, Cloves and Cinnamon, Liver, Biomarkers of a healthy liver

Introduction

The liver, which is the largest organ in the intestinal tract that can do several very complex jobs. This organ has a highly vital role for survival since it plays a role in the process of metabolism, detoxification, protein synthesis, hormone regulation, and can prevent many diseases, maintaining liver health is very important because of its complicated nature. Unfortunately, liver damage can be caused by a number of circumstances, including poor diet, toxin exposure, infection, and unhealthy lifestyle (Kwo et al., 2017). The liver, which has the main filtering site in the body, works against bacteria or viruses, prevents inflammatory responses caused by microbial

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derivatives entering the bloodstream from the gut, and works to maximize immune cells against pathogens in the bloodstream (Kubes & Jenne, 2018).

Liver disease, which includes cirrhosis, viral hepatitis, and liver cancer, causes approximately two million fatalities yearly and accounts for 4% of all deaths globally (1 out of every 25 deaths); women account for one out of every three liver-related deaths. Men account for almost two thirds of liver-related deaths (Devarbhavi et al., 2023). This organ is highly susceptible to various pathologies, mainly related to its many functions, structural organization, strategic localization, and cell sensitivity (Farzaei et al., 2018). Therefore, maintaining liver function in natural ways is becoming increasingly vital.

There are a number of exposures-such as smoking, alcohol use, viral infections, and some chemical exposures-that are associated with some liver disorders. In this study, the breadth of chemical exposures was not explored. Another important finding is that multiple exposures often play a role in the onset of a disease, as in the viral agent-chemical combination, chemical exposures from the workplace, among many others. In fact, most liver diseases may stem from the confluence of many variables, hence the need for an exposure-based approach (Barouki et al., 2023).

The use of herbal teas that utilize plants with high antioxidant content is one strategy that is starting to attract interest. In tea form, a blend of mangosteen pericarp, cloves, and cinnamon can protect the liver from oxidative damage and inflammation (Gopalakrishnan et al., 2016). The bioactive components of these three plants have been examined for a variety of health advantages, including hepatoprotective properties, which assist maintain healthy liver function (Saeed et al., 2018).

The purpose of this article is to explore, analyze and summarize various theories about the potential of a mixture of mangosteen, cinnamon, clove tea, hepatoprotective mechanisms, and liver health biomarkers in terms of antioxidant content. This study explores in depth the antioxidant content of mangosteen pericarp, cloves, and cinnamon, how these substances protect the liver, and how biomarkers determine liver function. By recognizing the potential of this blended tea, it is envisaged that it can give a natural alternative to promote liver health preventively and support the treatment of existing liver diseases.

Material of Writing

This research method uses a literature review that focuses on relevant international and national scientific journals. The purpose of this research method is to explore, analyze, and summarize various theories about how mixed mangosteen peel, clove, and cinnamon tea can help liver health. This method allows researchers to find new findings and combine various perspectives from current literature to make more in-depth conclusions.

Steps for Literature Review:

1. Literature Search: The search was conducted using scientific databases such as PubMed, ScienceDirect, Google Scholar, and national journal portals such as Garuda and Neliti. Using the keywords "Mangosteen peel and liver health", "cloves and hepatoprotection", "cinnamon and liver antioxidants", and other relevant keywords.
2. Literature selection: To ensure that the analyzed data are the most recent, the selected articles were published in the last ten years. Laboratory studies, clinical trials, and literature reviews discuss the hepatoprotective effects of mangosteen peel, cloves, and cinnamon.
3. Literature Analysis: Each relevant article was reviewed to ensure consistency of research results, techniques used, and key conclusions. The main focus was on the bioactive constituents of the plant, how it protects the liver, and its effects on liver health that have been reported.
4. Theory Synthesis: After the literature analysis was conducted, the theories found were combined to gain a broader and deeper understanding of the possibilities of this blended

tea. This process included combining various results that supported each other, as well as assessing the relevance and appropriateness of the existing data.

5. New Conclusions Developed: This study combines the literature analyzed and reaches new conclusions that offer a stronger theory about how a blend of mangosteen pericarp, clove, and cinnamon tea may help liver health. These conclusions are based on existing evidence and incorporate new findings that have not been widely discussed in previous research.

Results and Discussion

Mangosteen pericarp

Mangosteen (*Garcinia mangostana* L.) is a fruit tree native to the shaded tropical woods of Southeast Asia. Known for its sweet, white flesh with a somewhat acidic taste, the mangosteen tree offers thick, purple-skinned fruit. This plant thrives best in tropical regions that have a humid atmosphere and consistent temperatures throughout the year. Mangosteen pericarp, especially the pericarp, is intensively studied for its bioactive chemicals that have high health potential.

Table 1. Taxonomy of mangosteen

Kingdom (*kingdom*)	Plants
Division (*division*)	Magnoliophyta
Class (*class*)	Magnoliopsida
Order (*order*)	Malpighiales
Family (*family*)	Clusiaceae
Genus (*genus*)	Garcinia
Species (*species*)	G. mangosteen

Source: Hollis (2020)

Mangosteen is widely known for its excellent antioxidant qualities, mainly due to the bioactive chemicals contained in its peel. Antioxidants are chemicals that counteract oxidative damage caused by free radicals in the body, which can lead to many degenerative diseases such as cancer, heart disease, and premature aging. Bioactive substances discovered in mangosteen peel are: Xanthones the main compounds found in mangosteen peel are xanthones, especially α-mangostin, γ-mangostin, and β-mangostin. Xanthones have strong antioxidant, anti-inflammatory, and anticancer properties. Tannins: Mangosteen pericarp also contains tannins, which are known to have antibacterial and anti-inflammatory activities. Tannins can help in treating various infections and inflammations. A flavonoid in mangosteen skin acts as an antioxidant and can help protect body cells from oxidative damage. Polyphenols: Polyphenolic compounds contribute to antioxidant activity and other potential health benefits. Saponins: Saponins are found in mangosteen pericarp and have immunomodulatory properties and potential as anti-tumor agents (Huang et al., 2020)

Cinnamon

Cinnamomum burmannii is a sweet spice that comes from the inner bark of trees with the genus Cinnamomum and the family Lauraceae. Cinnamon can be used in various dishes and traditional medicine because of its distinctive sweet aroma. Traditionally, cinnamon is used to treat digestive problems, improve heart health, and has anti-inflammatory, antimicrobial, and antioxidant properties (Geograf.id, 2023).

The content of cinnamon compounds includes alcohol compounds, saponins, flavonoids, phenolics, steroids, and tannins. In Dewi's research (2023), the IC50 value of the cinnamon sample was 3.24 ppm, so the activity of cinnamon as an antioxidant with an IC50 value <50 ppm, based on exposure to the test results, cinnamon has a very strong antioxidant capacity.

Clove

Cloves (*Syzygium aromaticum*) are a spice that contains antioxidants, especially eugenol, which is very important for protecting the body from oxidative stress and various degenerative diseases. Antioxidants in cloves help fight inflammation, protect cells from damage, and function as antibacterials (Pramono, 2020).

Clove essential oil contains eugenol, which has antibacterial and antioxidant properties, as shown by Zhang et al. (2017). In addition, its ability to prevent DNA damage caused by free radicals and slow down the aging process of cells has also been documented in recent studies.

Liver organ

According to Hall (2020) in Guyton and Hall Textbook of Medical Physiology (14th ed.), the liver is an important part of the human body that performs various important tasks. The liver also produces bile, which is important for the digestion of fats, and serves as a storage for various important substances, such as glycogen, vitamins, and minerals, and is responsible for the metabolism of nutrients, including carbohydrates, fats, and proteins.

The liver also forms plasma proteins such as albumin and blood clotting factors, regulates blood volume and osmotic pressure, and plays a role in the synthesis of other proteins. Therefore, the liver has an extraordinary regenerative capacity, which allows most of its functions to continue even if the liver is severely damaged. The liver is also important for maintaining blood glucose balance, by metabolizing and storing glucose in the form of glycogen, and releasing it back into the blood when needed by the body. If liver function is impaired, such as in cirrhosis or hepatitis, this can cause serious problems in the body's metabolism.

How antioxidants work for liver health

Redox homeostatis is a mechanism to balance the production of electron concentration in the body, which is one of the cell's abilities to face challenges. Redox will be affected by the balance of ROS in the body. If ROS generation increases due to the activity of lipoxygenase, P450 cytochrome, NADPH oxydase, mitochrondrial and other sources, this will increase ROS and increase homeostatis. This will increase oxidative stress which will then increase the risk of liver disease due to cell and tissue damage. In ROS Elimination, redox homeostatic balance can occur when antioxidant enzymes increase (He et al.,2017), which will eliminate oxidation directly or indirectly and decrease oxidative stress, thus preventing liver disease (Zhou et al., 2020) (Figure 1).

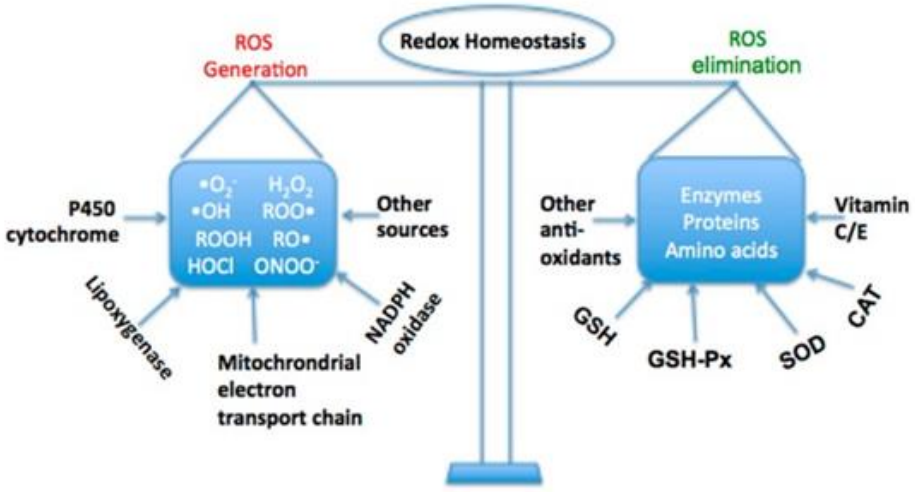

Figure 1. The redox homeostasis in the liver (Li et al., 2015)

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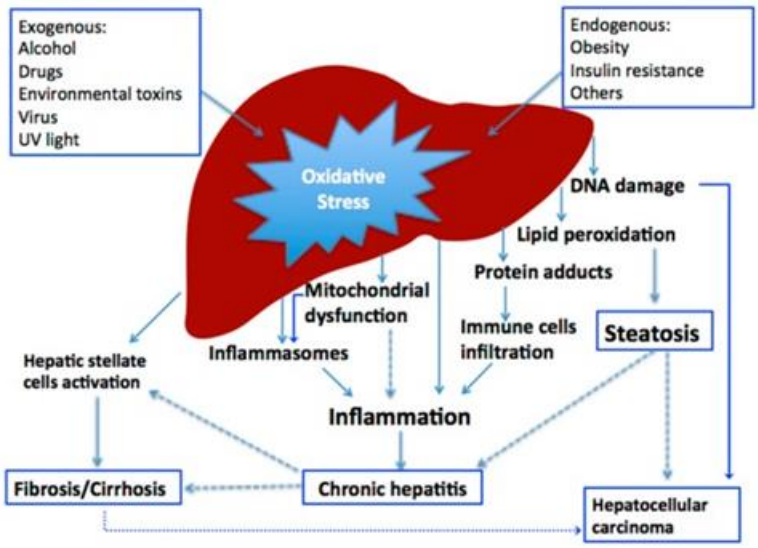

Figure 2. The general mechanism scheme of oxidative stress induced by various factors on liver disease (Li et al., 2015)

This picture shows the mechanism of the liver undergoing oxidative stress due to several causes. 1). External causes can be caused by food, drinks, drugs, viruses, and toxic environments, while 2). internal causes are when a person experiences or suffers from obesity, diabetes and other diseases that can increase oxidative stress in the liver. This will give an inflammatory reaction which then develops into several liver diseases such as steatosis, fibrosis, chronic hepatitis, and hepatocellular carcinoma.

Antioxidants keep the liver healthy by protecting cells from oxidative damage, which can cause a variety of liver diseases. When the production of free radicals is higher than the body's capacity to neutralize them, this is where antioxidants work to keep the liver healthy. Free radicals can cause hepatitis and cirrhosis by destroying liver cell lipoproteins, proteins, and DNA.

In order to prevent or cure diseases linked to oxidative stress, antioxidants can neutralize ROS. Antioxidants are essential for preserving optimum cellular function because they counteract free radicals. Furthermore, antioxidants are necessary to safeguard biological systems because they stop new radicals from forming, capture free radicals to stop chain reactions, and repair damage that free radicals have caused. The defense system's antioxidants function on several levels, including repair, adaptability, antiradical, and prevention. Additionally, antioxidants have the ability to scavenge reactive radicals in order to stop the start of a chain or interfere with its proliferation. Mammalian cells' cytosol and mitochondria contain repair antioxidants that recognize, degrade, and eliminate oxidatively damaged proteins to stop the accumulation of oxidative proteins (Ayoka, et al., 2022).

Giving polyphenol compounds to mice up to day 16 MPE was generally able to produce hepatoprotective effects, especially based on SGOT variables at dosages of 200 and 400 mg/kg, demonstrated that experimental mice's liver function is still largely normal. This occurs because MPE polyphenols have a role in preventing cell swelling, which can lead to liver enlargement and body weight, and because polyphenols protect NAD+ and antioxidant levels, which may shield against elevated SGOT and SGPT levels brought on by necrosis from oxidative stress following borax induction (Pratiwi et al., 2016).

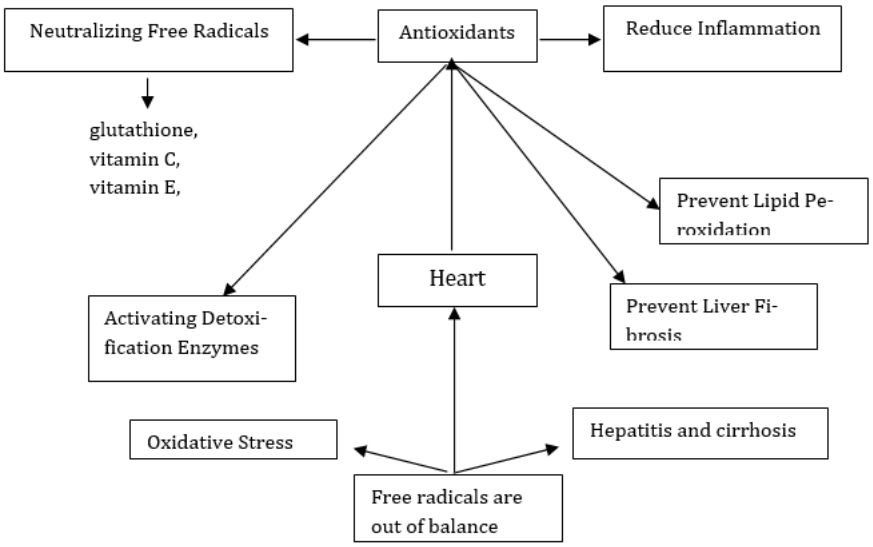

Figure 3. Mechanism of action of antioxidants for liver health (Kasper et al.,2015)

Liver health biomarkers

To assess liver health or detect liver damage, several important biomarkers can be measured through blood tests. These biomarkers include liver enzymes and proteins that play a key role in liver function. Here are some of the key biomarkers commonly measured:

1. SGPT (Serum Glutamate Pyruvate Transaminase) or ALT (Alanine Aminotransferase): This enzyme is normally found in the liver. Increased SGPT levels indicate liver cell damage, such as in hepatitis or fatty liver disease (Rosida, 2016). Normal range ALT 0 to 45 IU/L.
2. SGOT (Serum Glutamate Oxaloacetate Transaminase) or AST (Aspartate Aminotransferase): In addition to the liver, SGOT is also found in the heart muscle and other tissues. Elevated SGOT levels can indicate liver damage, but because it is also found in other tissues, it is often compared with SGPT to determine the source of damage (Rosida, 2016). Normal range AST 0 to 35 IU/L.
3. SGPT/SGOT ratio: This ratio is sometimes used to differentiate types of liver damage. For example, a ratio greater than 1 usually indicates acute viral hepatitis, while a ratio less than 1 may indicate chronic liver damage such as cirrhosis.
4. Gamma GT (Gamma-Glutamyl Transferase): Gamma GT is an enzyme that is high in the cells of the bile ducts and liver. Elevated levels of Gamma GT may indicate damage to the bile ducts or excessive alcohol consumption. In liver cells gamma GT is found in the endoplasmic reticulum while in bile it is found in epithelial cells. Increased GGT activity can be seen in obstructive icterus, cholangitis and cholestasis (Rosida, 2016). Normal range GGT 0 to 30 IU/L.
5. Alkaline Phosphatase (ALP): This enzyme is found in various tissues, including the liver, bones, and bile ducts. Elevated ALP levels may indicate liver disease or bile duct obstruc-

tion. Low ALP levels in patients with cirrhosis can be caused by Wilson's disease and deficiencies of protein, zinc and magnesium (Sharma, 2022). Normal range ALP 30 to 120 IU/L**.**

6. Albumin and Globulin: Albumin is the main protein produced by the liver, and its level in the blood can reflect the liver's ability to synthesize proteins. Globulins can also be elevated in chronic liver disease. Changes in the albumin/globulin ratio can indicate liver problems. Normal range 40 to 60 g/L.
7. Bilirubin: Bilirubin is a breakdown product of hemoglobin. Increased levels of bilirubin in the blood may indicate impaired excretion of bilirubin by the liver, such as in jaundice. Laboratory examination of bilirubin consists of examining total serum bilirubin, recombinant serum bilirubin, and indirected serum bilirubin, urinary bilirubin and its derivatives such as urobilinogen and urobilin in urine, and stercobilin and stercobilinogen in faeces (Rosida, 2016). Normal range 2 to 17 micromoles/L
8. Bile Acid Levels: Hepatocytes produce bile acids by converting cholesterol to either taurine or glycine, which are then released into bile. Hepatic blood flow, hepatic absorption, bile acid secretion, and intestinal transit are all necessary to maintain normal serum bile acid concentrations. Sensitive yet non-specific markers of hepatic impairment include serum bile acids. Additionally, it permits some functional hepatic reserve quantification (Sharma, 2022).

Antioxidants in mangosteen, cinnamon and cloves and liver health

Hadi et al. (2018) Research**.** "*The protective effect of Garcinia mangostana (mangosteen) against liver damage: An overview* " It was found that mangosteen extract can reduce liver damage caused by hepatotoxic agents such as paracetamol. Xanthones in mangosteen can reduce elevated liver enzyme levels, such as ALT and AST, and reduce oxidative stress in the liver.

Other research is according to Ding et al. (2021)**.** "*Antioxidant and anti-inflammatory effects of mangosteen extract in liver injury models.* In this study using an animal model of liver injury, mangosteen extract showed significant antioxidant and anti-inflammatory properties, thereby reducing inflammation and improving liver function.

According to research by Tariq et al. (2019). "*Cinnamon and its antioxidant potential in liver health*" This study shows that cinnamon extract can reduce lipid levels and increase antioxidant enzyme activity in the liver, as well as reduce liver damage induced by a high-fat diet.

Meanwhile, according to research by Zhang et al. (2022) With the title " *Effects of cinnamon extract on liver fibrosis and oxidative stress in diabetic rats* " In a diabetic rat model, cinnamon can reduce liver fibrosis and reduce stress, and shows therapeutic potential in diabetes-related liver disease.

Research related to cloves and liver organs, namely according to Khan and Ahmad (2020). "*Hepatoprotective and antioxidant activity of clove extract in carbon tetrachloride-induced liver injury* " The hepatoprotective activity of clove extract is shown by reducing liver damage caused by carbon tetrachloride and increasing the antioxidant status of the liver.

According to research by Ali and Shams (2021). "*The effects of clove (Syzygium aromaticum) on oxidative stress and liver function in patients with non-alcoholic fatty liver disease*". This study found that patients with non-alcoholic fatty liver disease can improve liver function and reduce oxidative stress by taking clove supplements.

Conclusion

Based on the literature that has been conducted, it is found that Mangosteen is rich in polyphenolic compounds, especially xanthones, which have strong antioxidant properties. Studies have shown that mangosteen extracts can provide protection against liver damage caused by various oxidative stress factors. Cinnamon contains various phenolic compounds, such as cinnamaldehyde, which have antioxidant activity and can play a role in protecting the liver from

oxidative damage and improving lipid metabolism. While cloves contain eugenol and other phenolic compounds known to have antioxidant properties. Research shows that cloves may provide protection against liver damage by reducing oxidative stress and inflammation. In order to prevent or cure diseases linked to oxidative stress, antioxidants can neutralize ROS. Antioxidants are essential for preserving optimum cellular function because they counteract free radicals. Furthermore, antioxidants are necessary to safeguard biological systems because they stop new radicals from forming, capture free radicals to stop chain reactions, and repair damage that free radicals have caused.

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