

T.chebula and Its Medicinal Value

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Abstract This paper contains some of the information about the *Terminalia chebula* a well-known medicinal plant grows in India. The main discussion is on some of the chemical compounds that are mainly found in *T.chebula*. Here the structures of the compounds along with their uses are mentioned.

Keywords *T.chebula*; Chemical Compounds of *T.chebula*; Haritaki; Medicinal Value of Compounds Found in *T.chebula*

1. Introduction

Terminalia chebula, the most common medicinal plant grows mainly in the sub Himalayan tracks from Ravi eastwards to west Bengal and Assam. The tree is mainly of 15.24m in height and 1.5-2.4m in girth with a cylindrical bole of 4-9m. It is also called the 'king of medicines' in Tibet. This plant is considered as medicinal plant from thousands of year in Ayurveda. The bark of Terminalia has been used in India for more than 3000 years. It is used primarily as heart remedy. An Indian physician named Vagbhata has been credited as the first to use this product in the seventh century A.D. Research on terminalia has been going on since the 1930s. In Ayurveda it is thought that *T.chebula* destroys all the germs in the body and cleans the body. The main useful parts are bark, leaves, fruits and flowers. Modern science found that the tree is capable of resisting many diseases in case of animals. This is mainly considered as the resistor of heart diseases, nausea and other abnormalities. According to Ayurveda there are many sub-divisions in *T.chebula* like Vijaya, Rohini, Putana, Amruta, Abhaya etc. of which Vijaya variety is considered as best.

2. Constituents Associated with *Terminalia Chebula*

So many phytochemical constituents are found in *T.chebula* extract which are very much useful in medicinal purpose. The phytochemical extracts consist of Tanin (15-20%) which after hydrolysis gave chebulic acid and D-galloyl glucose. Beside these the carbohydrate like glucose and sorbitol are present in the extract. *T.chebula* possesses glycoside compound like Chebuloside I and II. It also contains phenolic compounds like Ellagic acid, 2,4-chebulyl- β -D-glucopyranose, Chebulinic acid (3-

5%), Gallic acid, Ethygalate, Punicalagin, Terflavin-A, Terchebin, Luteolin, Tannic acid (30%), Luteic acid and other components like Acoumarin and Chebulin. It also contains some other compounds.

3. Descriptions of Functional Compounds

The extract of *T.chebula* has antioxidant effect, hepatoprotective effect, cryptoprotective effect, antidiabetic effect and so on. The functional compounds are specially the major cause of these effects. Some of the constituents are explained below:

3.1. Tannin

The polyphenolic compound present in *T.chebula* is tannin (15-20%). It is mainly found in leaf, bud, seed, root, and stem tissues of a plant. Sometimes it is found in secondary phloem, xylem i.e. the growth areas of trees.

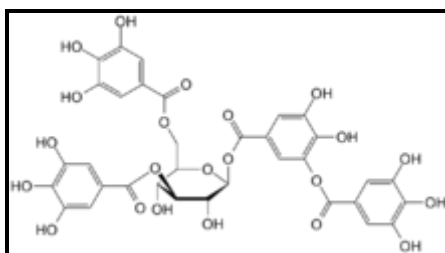


Figure 1: Tannic Acid (One Type of Tanin)

Tannin has a poor contribution in antioxidant activity and cardiovascular activity. Other sources from where we can get Tannin are fruits like pomegranates, berries, nuts; smoked food like cherry, oak; and also in herbs, spices, legumes and chocolates.

3.2. Chebulic Acid

One of the phenolic compounds mainly extracted from the ripe food of *T.chebula* is Chebulic acid. The compound also possesses an isomer Neochebulic acid.

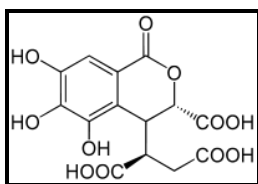


Figure 2: Chebulic acid according to Lee, 2010 [1]

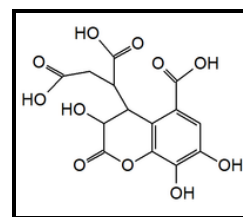


Figure 3: Chebulic acid according to Klika, 2004 [2]

This compound acts as a hepatoprotective compound [3]. Chebulic acid was used to prevent advanced glycation end products-induced endothelial cell dysfunction; however the antidiabetic effect of chebulic acid is questionable [4].

3.3. Chebuloside II

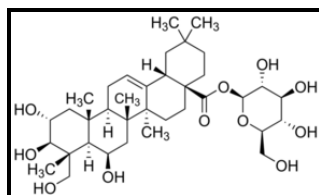


Figure 4: Chebuloside II

The molecular formula of chebuloside II is **C₃₆H₅₈O₁₁** and the molecular weight is 666.84 g/mol. It has hepatoprotective activity against anti-tuberculosis (anti-TB) drug-induced toxicity. TC extract was found to prevent the hepatotoxicity caused by the administration of rifampicin (RIF), isoniazid (INH) and pyrazinamide (PZA) (in combination) in a sub-chronic mode (12 weeks). The hepatoprotective effect of TC (*T.chebula*) extract could be attributed to its prominent anti-oxidative and membrane stabilizing activities [5].

3.4. Ellagic Acid

One of the most useful compound present in *T.chebula* is Ellagic acid. It is marketed because of having the ability to prevent and treat a number of human maladies, including cancer. But these claims have no such strong proofs. Actually plants produce Ellagic acid from hydrolysis of Tanins.

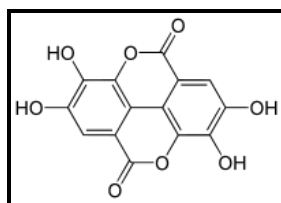


Figure 5: Ellagic Acid

The molecular formula of Ellagic acid is **C₁₄H₆O₈** and the molecular weight is 302.19 g/mol. Ellagic acid has some anti-cancer properties. It also acts as an antioxidant and cause apoptosis in cancer cells. It reduces the effect of estrogen in promoting growth of breast cancer cells in tissue cultures. There are also reports that it may help the liver to break down or remove some cancer-causing substances from the blood. It is also claimed that Ellagic acid also reduces heart disease, birth defects, and liver problems [6]. The present available research does not support these claim at this time. This ellagic acid can be extracted from many other sources like oaks, macrophytes (*Myriophyllum spicatum*) and medicinal mushroom (*Phellinuslinteus*) [7]. It is available also in some fruits like wild strawberries, raspberries, blackberries, cloudberries, pomegranate, walnuts, pecans, beefsteak fungus, and cranberries [8].

3.5. Chebulinic Acid

One of the important phenolic compound present in *T.chebula* is Chebulinic acid. It is mainly found in the fruit of the tree [9].

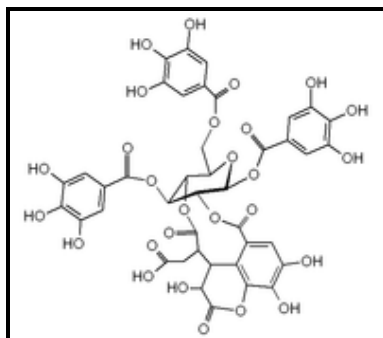


Figure 6: Chebulinic Acid

The molecular formula of Chebulinic acid is $C_{41}H_{32}O_{27}$ and the molecular weight is 956.67 g/mol. Some researchers claim that it has antihypertensive activity. It has some inhibitory effect on erythroid differentiation likely through changing transcriptional activation of differentiation relative genes, which suggests that Chebulinic acid or other tannins might influence the efficiency of some anti-tumor drug induced differentiation or the hematopoiesis processes. It is also found in the seed of *Euphoria longana* [10].

3.6. Gallic Acid

Gallic acid is a trihydroxybenzoic acid, a type of phenolic acid.

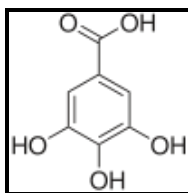


Figure 7: Gallic Acid

The molecular formula is $C_6H_2(OH)_3COOH$. Gallic acid seems to have anti-fungal and anti-viral properties. Gallic acid acts as an antioxidant and helps to protect our cells against oxidative damage. Gallic acid was found to show cytotoxicity against cancer cells, without harming healthy cells. Gallic acid is used as a remote astringent in cases of internal haemorrhage. Gallic acid is also used to treat albuminuria and diabetes. Some ointment to treat psoriasis and external haemorrhoids contains gallic acid. It is also found in oak species; stem bark of *Boswelliadalzielii*, *Drosera*, *Rhodiolarosea*, *Toona sinensis*, etc. [11].

3.7. Punicalagin

Punicalagin is an ellagitannin.

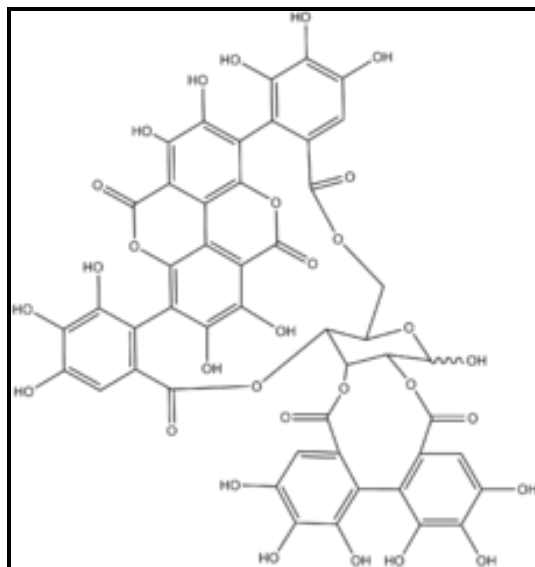


Figure 8: Punicalagin

The molecular formula of Punicalagin is $C_{48}H_{28}O_{30}$ and the molecular weight of this compound is 1084.71 g/mol [12]. Medicinal purpose is not well-known.

3.8. Luteolin

It is a flavone, a type of flavonoid. It has a yellow crystalline appearance. It is most often found in leaves, but it is also seen in rinds, barks, clover blossom, and ragweed pollen [13].

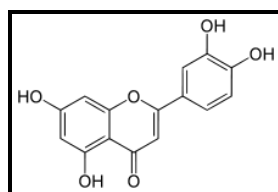


Figure 9: Luteolin

The molecular formula of $C_{15}H_{10}O_6$ and the molecular weight is 286.24 g/mol. It was used in China as a traditional medicine for treating various diseases such as hypertension, inflammatory disorders, and cancer. It functions as either antioxidant or pro-oxidant biochemically. Luteolin's anticancer property is associated with the induction of apoptosis, and inhibition of cell proliferation, metastasis and angiogenesis [14]. Furthermore, luteolin sensitizes cancer cells to therapeutic-induced cytotoxicity through suppressing cell survival pathways such as phosphatidylinositol 3'-kinase (PI3K)/Akt, nuclear factor kappa B (NF-kappaB), and X-linked inhibitor of apoptosis protein (XIAP), and stimulating apoptosis pathways including those that induce the tumor suppressor p53 [15]. There are many adverse effect caused by Luteolin in human being. Nausea, vomiting, and gastric hypersecretion, may occur. It was seen in one animal study. It has adverse effects in laboratory studies with endometrial cancer cells by blocking endocrine effects of the hormone progesterone [16]. It is found in celery, broccoli, green pepper, parsley, thyme, dandelion, perilla, chamomile tea, carrots, olive oil,

peppermint, rosemary, navel oranges, and oregano. It is also found in the seeds of the palm *Aiphanes aculeata*.

3.9. Luteic Acid

It is a natural phenol present in the myrobalanitannin, tannin found in the fruit of *Terminalia chebula*. This was showed by Maximilian Nierenstein in the year of 1945. It is also an intermediate product in the synthesis of ellagic acid.

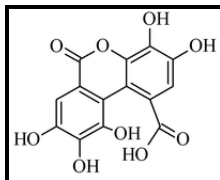


Figure 10: Luteic Acid

The molecular formula of luteic acid is C₁₄H₈O₉ and the molecular weight is 320.21 g/mol. Medicinal purpose of this component is also not well-known [17].

4. Conclusion

T.chebula, a well-known medicinal plant contains various chemical compounds. Some of the chemical compounds are briefly discussed here, although some of the chemical compounds along with their medicinal use are not well known.

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