



# A Brief Overview of *Bergeniaciliata* as a Potential Treatment for Liver Illness

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## ABSTRACT

*Insulin resistance and oxidative stress are the primary contributors to the damage and loss of liver cells that occur in these individuals. Researchers are looking at the potential benefits and applications of Bergeniaciliata for the very first time in the context of the treatment of liver conditions. Bergeniaciliata, which is a member of the family Saxifragaceae and is known for its adaptability, is regarded a wonder plant since it can be used in a variety of purposes. This piece of literature contains an in-depth analysis as well as a summary of data obtained from a variety of sources located in India and all over the globe. This research looks at scholarly publications such as journals and theses, as well as bibliographical databases such as PubMed and Scopus. When B. ciliata was analyzed for its phytochemical composition, a variety of compounds, including phenols, flavonoids, fatty acids, glycosides, and terpenoids, were found to be present. These are only some of the chemicals. As a result of the existence of these bioactives, the B. ciliata plant as a whole may be used for a variety of medical purposes. In addition to this, it is capable of reducing fever, fighting bacteria, and alleviating inflammation.*

**KEYWORDS:** *This page covers a variety of subjects, some of which are ciliated bergenia phytochemicals, hepatoprotective properties, medical applications, and liver diseases.*

## BACKGROUND

Liver disease is now a significant cause of mortality and sickness all over the globe, and chronic alcohol use as well as contemporary lifestyles are key contributors to its development (Iqbal et al., 2019). It is estimated that three million people pass away as a direct result of alcohol-related causes every single year throughout the whole planet (WHO, 2019). The condition known as non-alcoholic steatohepatitis, or NASH, affects a large number of people and has been linked to hepatic fibrosis, cirrhosis, and eventually hepatocellular cancer (Ahmad & Ahmad, 2012; Page & Harrison, 2009). Because there is now no treatment available for chronic liver disease, an increasing number of patients are in need of a liver transplant. This is a significant problem from both a medical and a monetary point of view. It is thus vital to find therapeutic alternatives that are both effective and inexpensive in order to contribute to the decrease of mortality and morbidity caused by CLD. Because of its capacity to ward against diseases and ailments, herbal medicines have garnered a lot of respect all over the enormous variety of plants that are used in medicine that may be discovered in India, the country is often referred to as the "Medicinal Garden of the World." Because of the healing properties of these plants, a significant portion of the world's population still has access to treatments that are available at more affordable prices (Sen & Chakraborty, 2017).

One of the most well-known and highly esteemed plants in the family Saxifragaceae, also known as the Saxifragaceae genus, has been used for the treatment of a broad variety of human ailments for thousands of years. The names "Pakhanabhed" and "Zakhmehayat" are the ones most often used to refer to this evergreen perennial plant that may be found all over ground is covered with leaves that are starting to wilt. Terminal corymbs that have flowers of a pink, white, or purple hue are particularly common in gardens and several other types of settings. *B. ciliata* has been put to use as a remedy for a wide variety of illnesses for hundreds of years in the Himalayas (Chowdhary et al., 2009). *Bergeniaciliata* is acclaimed as a miracle plant because to its success in curing a broad variety of ailments, including difficulties with the gastrointestinal tract, lung infections, heart illness, ophthalmic disorders, hemorrhoids, and stones in the kidney and gall bladder. It's been shown that.. (Husain et al., 2019; Rajkumar et al., 2011). In addition, the plant has qualities that enable it to be useful as a diuretic, an antitussive, a chemical that inhibits the development of cancer cells, an anti-inflammatory, an antiviral, an antibacterial, an antimalarial, and a disease fighter (Rajkumar et al., 2011; Ruby et al., 2012; Timalsena & Lamichhane, 2019; Zafar et al., 2019). Urolithiasis is a disorder that may be treated, and there is a possibility that an Ayurvedic polyherbal combination called Cystone, which includes bergenia in addition to other



herbs, might be utilized for the treatment of this ailment. Cystone consists of bergenia in addition to other herbs (Vidyashankar et al., 2010). Both the ability of plants to cure and their application in more conventional forms of medicine are inextricably tied to the phytochemical composition of plants (Fig. 1). It was revealed, throughout the course of phytochemical study that was carried out on this plant, that it contains a wide number of distinct chemicals. [Citation needed] These molecules include, amongst others, gallic acid (3,4,5-trihydroxybenzoic acid), bergenin (C-glycoside of 4-O-methyl Gallic acid), cat echin, gallicin, paashaanolactone, arbutin, -sitosterol, and afzelechin. Bergenin is a glycoside of gallic acid. Other substances that may be extracted from this plant (Dharmender et al., 2010; Kanth et al., 2019). Albumen, metatar bin, mineral salts, wax, tannic acid, and mucilage are only some of the many chemicals that have the potential to be present in the sample. Other possible components include mucilage. In addition to this, there is the likelihood that there will be mucilage (Kanth et al., 2019). The first step in the process of developing highly effective new medications is conducting research on medicinal plants in order to determine the presence of bioactive chemicals and the level of biological activity produced by those compounds. This research is done in order to identify the presence of bioactive chemicals. This step is the first one in the method, and it is also maybe the most significant one. This study is the first real effort to consolidate all of the scattered data on the protective effects of various bioacti that can be found across the scholarly literature. It was carried out by a team of researchers from the United Kingdom and the United States. In light of these circumstances, this review is the very first serious attempt to collect all of the data. Simply clicking on this link will take you to the review. [There must be other citations for this] [There must be other citations for this] [There must be other citations for this] [There must be other citations for this] [There must be other citations for this] [There must be other citations for this] The scientific literature has several examples of these facts being presented in a broad variety of contexts, each of which does so in a manner that is different from the others.

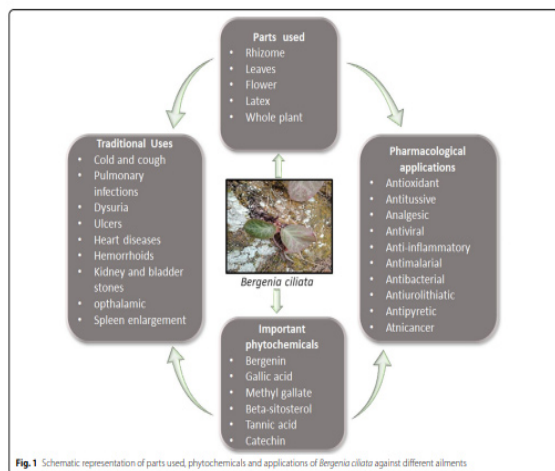
this, liver-damaging chemicals that are present in plants and drugs will become more potent over the course of the following several years. Because of this discovery, scientists all across the globe will have a greater understanding of the compounds and treatments that may be obtained from *B. ciliata*.

## METHODOLOGY

In the course of our comprehensive investigation, we discovered the anti-hepatotoxic properties of *Bergeniaciliata* as well as the scientific data supporting them. You may make use of any one of the numerous online bibliographic databases that are available in order to search for academic papers that have been published in scientific journals. After doing considerable study on the plant *B. ciliata* and the phytochemicals it contains, this article was prepared. The research was conducted using material available in English. It has been suggested that the potential of *Bergeniaciliata* to protect against liver illness may be described using the phrases hepatoprotective, hepatoprotective activity, and "hepatoprotective activity." For the purpose of this study, the information obtained from previous research was compiled into three figures and two tables.

## PHYTOCHEMICAL COMPONENTS AND ELEMENTS

Research on animal models, investigations into epidemiology, and clinical tests conducted on humans are all components of an all-encompassing method of conducting phytochemical research that takes into account each of these distinct aspects. This method of conducting research also takes into consideration an all-encompassing method of conducting research on phytochemicals. This way of doing research takes into account an all-encompassing approach of conducting research on phytochemicals as well as another method of conducting research. This approach of doing research was developed in order to take each of these characteristics of phytochemicals into account while conducting the study. As can be seen in Table 1, there are a great many different species of *Bergenia*, and research has shown that each and every one of these species has its own distinct set of phytochemicals. In addition, it is possible to find medicinal herbs, such as gallnuts and witch hazel (Nabavi et al., 2012). Individuals who spend their days engaged in the activity of Research (Nabavi et al., 2012) (Numerous studies have demonstrated that grapefruit extract (GA) is connected with a wide array of health benefits, including the capacity to stop the development of cancer cells as well as the transmission of viruses (Badhani et al., 2015; Kahkeshani et al., 2019). As we speak, at the exact same time that you are reading this (Badhani et al., 2015; Kahkeshan et al., 2019). Two of the activities that GA contributes to include the elimination and neutralization of free radicals, which are formed as a result of the metabolic processes that take place inside of cells (Badhani et al., 2015). (Badhani and the other professors and researchers that collaborated with him on this project, 2015) It is well knowledge that gallic acid



The medicinal components of this plant have been shown to be beneficial against liver illness. As a consequence of

has hydroxyl groups, and a number of investigations have led researchers to the conclusion that these groups could provide some hepatoprotective benefits (Anand et al., 1997). Antioxidant glutathione (GA), also known as glutathione, is an excellent treatment for liver damage brought on by a wide variety of factors, including chemotherapy and over-the-counter medications like paracetamol, to name just a few of these factors. Antioxidant glutathione (GA), also known as glutathione, is an excellent treatment for liver damage brought on by a wide variety of factors. Glutathione may also be used as a preventative measure to shield the liver from being harmed, which is one of its many potential applications. In recent years, academics have carried out investigations, and the findings of such investigations have shown that (Latief et al., 2016; Oyagbemi et al., 2016; Padma et al., 2011; Safaei et al., 2018).

This is a valid theory in light of the fact that GA seems to alleviate hepatic fibrosis in animal models by reducing inflammation, oxidative stress, and the activity of liver stellate cells. Researchers discovered that diabetic rats' glycoprotein and lipid peroxidation may profit from the teameliorative influence of streptozotocin-induced diabetes when they employ GA who conducted their research using a mouse model of the ailment (Chao et al., 2014). At the place of employment of Chao (2014). These data suggest that GA has the potential to alter the metabolism of lipids, ketones, amino acids, choline, glycolysis, and the microbiota in the intestines. The ability to manage glucose levels was improved in obese mice given GA, which also had an effect of lowering hyperglycemia (Bak et al., 2013). Bak and the others participated in the probe in some capacity.

According to Table 1, *Bergenia* species include a diverse assortment of chemicals that have biological activity.

Plant	Phytochemicals	References
<i>Bergenia ciliata</i>	Bergenin, Gallic acid, Gallicin, $\beta$ -Sitosterol, Arbutin, Catechin, Afzelechin, Linalool, Limonene, Pentanoic acid, $\alpha$ -Terpineol, Hexanoic acid, Hexalactone, Quercetin, Protocatechuic acid	Ahmad et al., (2018a, 2018b, 2018c) and Koul et al. (2020)
<i>Bergenia ligulata</i>	Bergenin, Gallic acid, Tannic acid, Arbutin, Catechin, $\beta$ -Sitosterol, Stigmastanol, Afzelechin, Methyl gallate, Quercetin, Coumarin	Ahmad et al., (2018a, 2018b, 2018c) and Koul et al. (2020)
<i>Bergenia stracheyi</i>	Bergenin, Gallic acid, Tannic acid, Phytol, Catechin-3-O-gallate Caryophyllene, Damascenone, $\beta$ -Eudesmol	Ahmad et al., (2018a, 2018b, 2018c) and Koul et al. (2020)
<i>Bergenia crassifolia</i>	Bergenin, Gallic acid, $\beta$ -Sitosterol, Arbutin, Catechin, Ellagitannins, Caffeoylquinic acid, Quercetin, Linalool, Pentadecanoic acid, Caffeoylquinic acid, Monogalloylquinic acid, Fumaric acid, Stearic acid	Ahmad et al., (2018a, 2018b, 2018c) and Koul et al. (2020)

In necroptosis-induced hepatocytes, the levels of HMGB1 and the receptor-interacting protein 1 (RIP1) were reduced due to the presence of glutathione (GA) (Zhou et al., 2019). Those who consume an excessive amount of alcohol have the ability to prevent necroptosis of their hepatocytes by increasing the expression of the gene NrF2. Tus, a protein that inhibits necroptosis and was discovered not long ago in the same way as Nrf2 is an antioxidant protein. The antioxidant and antiviral properties of GA were responsible for the observed reduction in the rate of hepatitis C virus infection in hepatoma cells, as the results of the research demonstrated (Govea Salas et al., 2016; Hsu et al., 2015).

Modulation of the STAT 3 signaling pathway and decreased production of PCNA by GA may be beneficial in the prevention of hepatocellular carcinoma (HCC) (Aglan et al., 2017; Jagan et al., 2008). Because of its high bioactivity, which includes antioxidant, anti-inflammatory, and apoptotic capabilities, it was something that was taken into account. It was decided to add GA in order to stop the P-815 mastocytoma cells from spreading to the liver (Ohno et al., 2001).

0.75 percent of bergenin (C<sub>14</sub>H<sub>16</sub>O<sub>9</sub>) is included in BERGENIN C<sub>14</sub>H<sub>16</sub>O<sub>9</sub>, which is a second metabolic product found in the root of the *Bergeniaciliata* plant (Ahmad et al., 2018a, 2018b, 2018c). There are many different plant species all over the world that contain isocoumarin in their leaves, roots, and bark (Patel et al., 2012). Two additional benefits are a lower chance of chronic illnesses such as heart disease, cancer, and other forms of malignancy, as well as a reduction in inflammation. Because of its antibacterial and antifungal properties, it may be used effectively in the treatment of a wide range of illnesses (Aggarwal et al., 2016; Ahmed & Urooj, 2012; Bajracharya, 2015; Bessong et al., 2005; Patel et al., 2012). There are no reported adverse effects associated with taking high doses of bergenin (Chauhan et al., 2012). When it was recognized that damage to the liver might cause changes in the pharmacokinetics of bergenin, its absorption was increased (Rong-Hua et al., 2016). These findings are vital for future investigations and ideas on the possible use of bergenin as a medication to protect the liver. In an animal model, it was shown that bergenin protects the liver from the effects of IR damage (Xiang et al., 2020). Through PPAR-dependent gene expression, the antioxidant properties of bergenin caused cells to undergo apoptosis as well as autophagy. It has been shown that Bergenin's participation in the treatment of carbon tetrachloride-induced liver necrosis is exceptional. [Citation needed] (Xia et al., 2020). The inhibition of autophagy by Bergenin led to the formation of damage in hepatocytes and a reduction in the deposition of collagen. In order to improve the animals' ability to keep their blood sugar under control, a combination of metformin and bergenin was given to the rats (Ambika & Saravanan, 2016). The activity of gluconeogenic enzymes was decreased in diabetic mice, but the activity of glycolytic enzymes was raised. Because of this drug, there was an increase in the amount of glucose that was released from the liver into the circulation. Bergenin, a particular chemical, increased both the activation of PI3K/Akt and the translocation of GLUT 2 in mice who had been fed an HFD. This phytochemical, which has been shown to activate and relocate GLUT 2 through PI3K/phosphorylated protein kinase B, has the potential to be used as a treatment for type 2 diabetes brought on by obesity (AKT). Bergenin was able to protect the hepatocyte livers from damage caused by TBHP as well as anti-alcohol-induced hepatotoxicity (Sriset et al., 2020). It was shown that activating the antioxidant-antioxidant system has hepatoprotective benefits. [Citation needed]

### βSITOSTEROL

-There are several foods that contain the plant-based

phytosterol BSS (BSS), which has the structure of cholesterol and may be found in foods like nuts and seeds. Some of these foods include: It may be found in a variety of plants and vegetables, one of which is the *B. ciliata* (Manjunatha, 2010).

- The therapeutic benefits of sitosterol may be applicable to a broad variety of conditions that are considered to be chronic (Yuan et al., 2019). Numerous research, including Baskar 2012, Berges et al. 1995, Gumede 2020, Jenkins et al. 2003, and López-Rubalcava et al. 2006, have shown that this phytosterol, along with others, may protect against the damage caused by free radicals. [Citation needed] Although CCl<sub>4</sub> is known to induce long-term damage to the liver in rats, BSS has been shown to give dose-dependent hepatoprotection in sick animals (Devaraj et al., 2020). After receiving the medication, it was discovered that the amounts of an antioxidant enzyme found in rats' livers, known as catalase, had reduced. It has also been proven that some markers of HSC activity have an antifibrotic effect (hydroxyproline, collagen and -SMA as well as desmin, vimentin and MMP 9). Because it alters the expression of the PPAR gene and boosts the activity of the PON-1 and ARE enzymes, BSS has been shown to have radioprotective effects (Moustafa&Tabet, 2017). The antioxidative, lipid-lowering, and PPAR agonistic capabilities of BSS, in addition to its other features, were all important contributors to this result. Researchers observed that the antioxidant and anti-inflammatory properties of BSS decreased the liver damage caused by LPS/GalN in mice (Yin et al., 2018). Their treatment improved antioxidant status in part by blocking the anti-inflammatory TLR4 pathway and activating the Nrf2 gene. [Citation needed] [Citation needed] It has been proven that both stigmasterol and a Western diet heavy in fat may provide protection against NAFLD (Feng et al., 2018). The phytochemicals' effectiveness against NAFLD was determined using lipidomic analysis of liver samples that had been taken during a therapy period of 33 weeks. These phytosterols have the potential to be used in the treatment of NAFLD in humans by lowering the patient's blood cholesterol levels (Table 2)

## **OTHER CHEMICAL COMPONENTS OF PLANTS**

*B. ciliata* has been found to contain a variety of phytochemicals, the most notable of which being arbutin and tannic acid. Arbutin is a glycosylated form of hydroquinone that may be found in the root systems of *B. ciliata* and several other green plants. It is an important component in the treatment of a broad variety of skin problems (Khanal et al., 2011; Kunwar et al., 2013). Infections of the urethra and kidney stones, in addition to bacterial infections of the bladder and kidneys, are all treatable with this medication (Funayama et al., 1995). Arbutin was able to inhibit the increase in toxicity that was caused by tert-butyl hydroperoxide in the Hep-G2 cell line (Seyfzadeh et al., 2012). Research conducted on animals suggests that arbutin may prevent oxidative damage caused by cyclosporine and CCl<sub>4</sub> from occurring in the livers of rats (Khadir et al., 2015; Mirshahvalad et al., 2016).

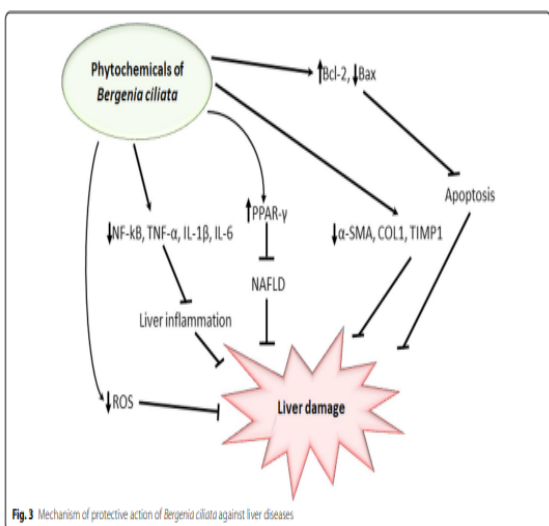
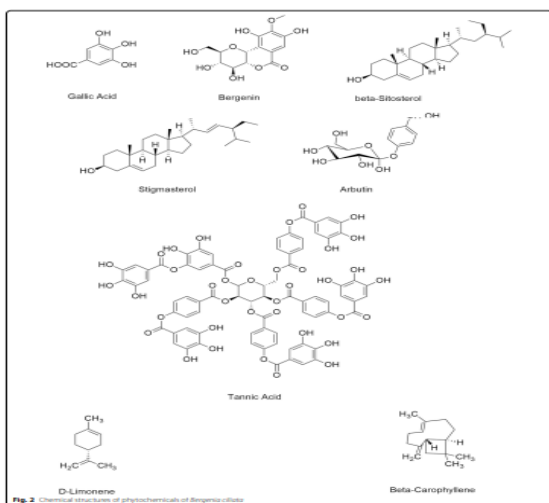
Arbutin's hepatoprotective properties have been linked to the substance's antioxidative, lipoperoxidative, and free radical-scavenging capabilities. Arbutin's capacity to reduce the amount of radiation-induced tissue damage in mice that had been subjected to therapeutic x-rays at high voltages is another piece of evidence indicating that the compound is an efficient radioprotector (Nadi et al., 2019). Although tussilagosterone combined with radioactive iodine has the potential to cause oxidative damage to the liver, arbutin has the potential to help. There are several different foods that contain polyphenols, such as the tannic acid (TA) that is produced by *B. ciliata* (Ahmad et al., 2018a, 2018b, 2018c; Fraga-Corral et al., 2020). In addition to being one of the most effective molecules for treating diabetes, this molecule also has powerful antiviral and antibacterial properties, and it has astringent properties (Chung et al., 1998; Kaczmarek, 2020). Due to the excellent liver-protective characteristics of TA, the livers of the mice were shielded from the CCl<sub>4</sub> and acetaminophen that would have otherwise caused fibrosis and damage (Chu et al., 2016; Zhang et al., 2017). Antioxidation, anti-inflammation, and anti-apoptosis are probably not the only mechanisms at play here; the probable mechanism is anti-inflammatory. Limonene is a kind of monoterpene that is found in many medicinal plants and may be found in the rhizome of the *B. ciliata* plant as well as citrus fruits (Adhikary et al., 2011; Kumar et al., 2010; Peng et al., 2009).

This colorless liquid has two optical isomers, which are d- and l-limonene, in addition to a racemic mixture of the two of them (Vieira et al., 2018). d-Limonene is marketed by some in the pharmaceutical business as having a variety of beneficial qualities, including those that are anti-inflammatory, anti-tumor, and antioxidant (Khan et al., 2013; Roberto et al., 2009). By alleviating the effects of free radical stress and inflammation, a substance known as d-limonene prevents Wistar rats from developing liver fibrosis as a result of CCl<sub>4</sub> exposure (Ahmad et al., 2018). A higher level of NF- $\kappa$ B activity led to improvements in antioxidant status, a decrease in collagen formation, and a lower level of inflammation. D-limonene protected diabetic rats against the harmful effects of free radicals by reducing the rate of lipid peroxidation and increasing the activity of antioxidant enzymes (Murali et al., 2012). If using d-limonene supplements may help minimize the symptoms of metabolic syndrome that are associated with NAFLD, then I am all for it! (Santiago et al., 2012). It was shown that administering limonene to rats reduced experimental hepatocarcinogenesis as a result of the compound's ability to both raise the rate of apoptosis and lower the rate of cell growth (Kaji et al., 2001). The rhizome of the *B. ciliata* plant has been shown to contain a bicyclic sesquiterpene that is often found in culinary herbs such as cinnamon, cloves, black pepper, and rosemary (Calleja et al., 2013; Jayaprakasha et al., 2003; Varga et al., 2018). This terpenoid, which lowers the expression of genes for collagen 11, TGF-1, and TIMP1, inhibits CCl<sub>4</sub>-mediated hepatic fibrosis and hepatic cell

activation. CCl<sub>4</sub> is the chemical that causes hepatic fibrosis (Calleja et al., 2013). Cayrophleneame, an anti-inflammatory compound that also has antioxidant properties, was given to mice as part of an experiment to determine whether or not it may exacerbate liver damage in persons who consume alcohol or who don't drink alcohol at all by influencing the levels of inflammation markers (Fig. 2).

## CONCLUSIONS

Within the scope of this study, the hepatoprotective qualities of *Bergeniaciliata* will be investigated for the first first time. The most common plant parts to be exploited are the plant's roots, leaves, and flowers, followed by its latex. This species contains not just flavonoids and phenols, but also fatty acids and glycosides in addition to those two types of compounds. These phytochemicals have been used as a treatment for a broad variety of illnesses in the Himalayas, including urinary and gastrointestinal issues, skin and respiratory troubles, gynecological concerns, and kidney infections, among other conditions. It is feasible to identify and quantify members of this phytochemical family by using HPLC, NMR, and FTIR (Ahmad et al., 2018a, 2018b, 2018c; Majeed et al., 2021). Bergenin has the potential to be separated both in the laboratory and in patients so that more research may be conducted.



In the relatively short amount of time that it will take for medical researchers to continue expanding their understanding of the structure and function of the liver, they will rapidly develop novel methods to the treatment of liver illnesses. Given the apparent lack of clinical evidence, more study is required to evaluate whether or not it has the potential to be utilized as a medicine that is both antifibrinolytic and hepatoprotective. This is important in order to identify whether or not it has this potential. It is predicted that future clinical research that is founded on the outcomes of this analysis will reveal that *B. ciliata* is a viable alternative treatment option that can be effectively adopted in contemporary medicine. As a direct result of this, the toxicity of the plant to living creatures is far less severe in comparison to that of conventional medications (Fig. 3) (Fig. 3)

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