ADVANCED Naturals

PRODUCT MONOGRAPH

LiverDTX 1

(NPN 80006120)

Product composition

Medicinal Ingredients:

Each capsule contains:

Selenium	50 mcg
Milk Thistle seed (Silybum marianum) (STD 80% silymarin)	125 mg
Phosphatidyl choline (from soy lecithin)	75 mg
Dandelion root (Taraxacum officinale) 4:1 extract (equivalent to 200mg)	5 0 mg
L-Taurine	50mg
L-Methionine	50mg
N-acetyl cysteine	50 mg
Alpha lipoic acid	25 mg
Artichoke leaf (Cynara scolymus) (STD 2% cynarin) 4:1 extract (equivalent to 100mg)	25 mg
Green tea leaf extract (Camellia sinensis) (STD 50% polyphenols)	25 mg
Turmeric root (Curcuma longa) (STD 95% curcumin) 57:1 extract (equivalent to 1425mg)	25 mg

Non-medicinal ingredients: Hypromellose, water

Recommended dose: Adults: Take 2 capsules in the morning on an empty stomach.

Duration of use: Use for a minimum of 3 weeks to see beneficial effects. Consult a health care practitioner for use beyond 12 weeks.

Indication: Used in herbal medicine to promote a healthy liver.

Contraindications: Do not use if you have a bile duct obstruction, gall bladder disorder, and/or bowel obstruction. Discontinue use if you develop symptoms of liver trouble. Hypersensitivity has been known to occur; in which case, discontinue use. Do not use if pregnant or breastfeeding. Do not exceed recommended dose.

Warnings: Keep out of reach of children.

Precautions: Consult a health care practitioner prior to use if you have diabetes, gallstones, liver disorder or develop symptoms of liver trouble (such as abdominal pain, dark urine or jaundice), have an iron deficiency, are taking antiplatelet medication or blood thinners, have ulcers and/or excess stomach acid.

Adverse Effects: Consult a health care practitioner if symptoms persist or worsen.

Overdose: For management of suspected product overdose it is recommended to contact your physician.

Symptoms of Overdose: Has not been investigated nor any reports have been filed.

Supporting Research and Traditional Evidence

Milk Thistle seed (*Silybum marianum*) (STD 80% silymarin)

The seed of the milk thistle plant has traditionally been used to confer liver protection. Many phytochemicals are present in the seed such as flavonoids, fatty oils and sterols. The active ingredient for liver protection is the mixture of flavanonol derivatives called silymarin. Silymarin is present in the casing of the seed and is mainly composed of the active constituent silybin, making up 60-80% of the flavonoid mixture (Bradley, 2006; WHO, 2002; Gruenwald *et al.* 2007). Pharmacologically, Sylmarin contributes to liver protection by 4 main mechanisms: 1) preventing the entry of liver-damaging substances into the cell by reducing the membrane permeability of the hepatocytes, 2) eliciting antioxidant activity by scavenging free radicals, 3) stimulating ribosomal function to facilitate regeneration of the liver cells and liver tissue, and 4) as an anti-fibrotic to inhibit hepatocyte transformation and deposition of collagen associated with cirrhosis (Bradley, 2006; Blumenthal, 1998). A systemic review by Tamayo and Diamond (2007) compiled several randomized clinical studies assessing the effects of milk thistle, standardized to silymarin content, on liver protection. Various types of liver disorders were included in the report, including hepatitis, chronic alcohol liver disease and cirrhosis. Overall the article suggests that milk thistle is effective in conferring liver protection to patients with liver diseases, in particular diseases involving alcohol-associated liver disease. The NHPD (2009) recognizes milk thistle seed as effective for liver protection with a good safety profile when taken at doses up to 3 - 14.5 g dried seed, standardized to 140-600 mg silymarin (calculated as silibinin/silybin), per day.

Phosphatidyl choline (from soy lecithin)

Phosphatidyl choline is commonly derived from the soy bean, in the form of lecithin. Soy lecithin contains other phospholipids among phosphatidyl choline, including phosphatidylehanolamine and phosphatidyl-inositol (Blumenthal *et al.* 1998). Traditionally soy lecithin has been used to reduce lipid levels within the body to promote a healthy liver. Phoshpatidyl choline elicits its effects at the cellular level by facilitating membrane rejuvenation and stabilization while inhibiting lipid peroxidation (Blumenthal *et al.* 1998). Phosphatidyl choline is degraded in the intestine to yield fatty acids, choline and glycerine-3-phosphate which are then absorbed and recirculated through the body by the lymphatic system. Recommended effective doses are 1.5 – 2.7 g of phospholipids derived from soy beans, and containing no more than 79% phosphatidyl choline per single dose (Blumenthal *et al.* 1998). Clinical studies have been performed to assess the effects of phosphatidyl choline on liver health. A phase III pilot study was conducted in which patients suffering from fulminant hepatic failure were treated with pholsphatidyl choline for 6-8 weeks. The results suggested that phosphatidyl choline produced a beneficial effect on liver health as suggested by decreased mortality rates (Singh and Prasad, 1998). Next, a multi-center, randomized, double-blind, placebo-controlled clinical trial was carried out to evaluate the effects of phosphatidyl choline as a combination therapy to promote liver health. One hundred and seventy-six patients suffering from chronic viral hepatitis were treated with a combination of phosphatidyl choline, or placebo, and interferon-γ daily for 24 weeks. Treatment with phosphatidyl choline showed significant improvements in liver function when compared to the placebo-controlled group. Treatment with phosphatidyl choline was continued for an additional 24 weeks and further improvements in liver function were observed suggesting that phosphatidyl choline when taken daily promotes liver health (Niederau *et al.* 1998). In the intestine, phosphatidyl choline is metabolized to choline which is recognized by the NHPD (2009) as a compound which confers liver protection with an established safety profile.

Dandelion root (*Taraxacum officinale*) 4:1 extract (equivalent to 200 mg)

Traditionally, dandelion root has been used in the treatment of various health conditions, specifically hepatobiliary problems. The main physiological action of the herb is to increase bile secretion from the gallbladder to promote liver health (Bradley, 2006). Active constituents of dandelion root include taraxcoside, sesquiterpene lactones, triterpenes, phenolic acids, as well as carbohydrates, vitamins and minerals (Bradley, 2006). *In vivo* and *in vitro* studies have been performed to assess the antioxidant effects of dandelion root. One *in vitro* study investigated the effects of dandelion root extract and the activities of several rat liver enzymes involved in the scavenging of free radicals. A dose-dependent antioxidant effect was observed following the treatment of liver microsomes with increasing doses of root extract (Hagymasi *et al.* 2000) suggesting that dandelion root functions as an antioxidant which may support liver health. A second study assessed the effects of a water extract of dandelion root on the activities of hepatic antioxidant enzymes and lipid deposition in diabetic Sprague-Dawley rats. Treatment with dandelion root resulted in a reduction in the amount of cholesterol observed in liver tissue with a corresponding increase in liver antioxidizing enzymes, such as superoxide dismutase (Cho *et al.* 2002). Scientific evidence suggests that dandelion root functions as an antioxidant to contribute to liver health. Recommended daily dosage is 1.5-24 g daily (NHPD, 2008). Dandelion root is commonly used as a coffee substitute and is ingested as a food in Europe (Newell *et al.* 1996; Bradley, 2006). The NHPD (2008) recognizes dandelion root as effective with an established safety profile in when taken in recommended doses.

L-Taurine

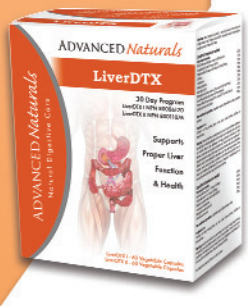
L-taurine is an organic acid and is the main component of bile. L-taurine has been shown to improve certain liver conditions in animals. One *in vitro* study assessed the antioxidant and hepatoprotective effects of L-taurine on hypochlorous acid-induced oxidative injury in rat liver. The researchers observed that treatment with hypochlorous acid alone reduced nucleoside triphosphatase activity within the hepatocytes in a dose-dependent manner. Nucleoside triphosphatase is an enzyme which catalyzes the breakdown of nucleotide triphosphates, such as ATP, which is important for the generation of cellular energy. Upon treatment with taurine, the extent of enzyme dysfunction was reduced. The study also investigated the effects of gluathione, a free radical scavenging enzyme in the liver, in place of taurine. When compared to glutathione, taurine was a better inhibitor of hypochlorous acid-induced liver toxicity (Li *et al.* 2003). These results strongly suggest that taurine is a good antioxidant to promote liver protection. An *in vitro* study investigated the effects of taurine on liver protection following ischemia-induced oxidative damage in rat liver. The results indicated a decrease in lipid peroxidation within the liver tissue and increased mitochondrial membrane stability when compared to control groups (Chen, 1993). Together these studies suggest a role for taurine as an antioxidant to promote a healthy liver. The NHPD (2009) recognizes taurine as effective in doses of 1.5-3 g/day with a good safety profile.

L-Methionine

L-methionine is a naturally occurring amino acid and is present in many foods such as nuts, cereal grains and meat. Scientific studies have been performed to assess the effects of methionine metabolism on liver function. A recent review article by Martinov *et al.* (2009) discusses the role of methionine metabolism in the liver. The article outlines the physiological process by which methionine is metabolized to S-adenosylmethionine. Clinical trials have been performed to assess the effect of the metabolite, S-adenosylmethionine, on liver function. One study by Mato *et al.* (1999) evaluated the effects of S-adenosylmethionine in patients suffering from cirrhosis of the liver. One hundred and twenty-three patients with treated with S-adenosylmethionine for 2 years and the patient mortality and liver transplantation rates were measured. Liver transplantation and patient mortality was decreased by half in the S-adenosylmethionine-treatment group when compared to the placebo-controlled group. This study suggests that S-adenosylmethionine, a metabolite of methionine, promotes liver health. The NHPD (2009) recognizes L-methionine as effective tin contributing to a healthy liver with a good safety profile when taken in recommended doses of 108.5 – 1000 mg/day.

N-acetyl cysteine

N-acetyl cysteine is a derivative of the amino acid L-cysteine. L-cysteine can



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be acquired through diet and metabolized to generate N-acetyl cysteine. Scientific evidence suggests a role for N-acetyl cysteine in promoting liver protection. A randomized double-blind placebo-controlled study assessed the effects of N-acetyl cysteine or placebo on liver function. Sixty patients suffering from septic shock were given N-acetyl cysteine or placebo. Significant improvements in the liver blood flow index and overall liver function were observed in the N-acetyl cysteine-treated group when compared to the control group (Rank *et al.* 1998). The results of the study suggest that treatment with N-acetyl-cysteine has a beneficial effect on liver function. A second clinical study assessed the effects of N-acetyl cysteine as an antioxidant in the treatment of ischemia-reperfusion injury caused by liver transplantation. Patients suffering from various liver disorders were randomly assigned to either the placebo-controlled group or N-acetyl cysteine-treated group. The researchers observed that when compared to the placebo-controlled group, treatment with N-acetyl cysteine produced improvements in portal vein and arterial blood flow, a reduction in the abundance of postoperative liver damage and upon histological analysis, a decrease in damage associated with reperfusion (Thies *et al.* 1998). These studies demonstrate a role for N-acetyl cysteine for liver protection with a good safety profile.

Alpha lipoic acid

Alpha lipoic acid is a naturally occurring acid within the body. The acid exists in two enantiomeric forms, but only the R-(+)-enantiomer exists in nature as an essential cofactor for various mitochondrial enzyme complexes. Clinically, alpha-lipoic acid has been implicated as an antioxidant to confer hepatoprotection. Alpha-lipoic acid elicits its antioxidant effects with a mechanism of action similar to that of glutathione. A pilot study was conducted to evaluate the effects of treatment with α-lipoic acid, glutathione or N-acetyl cysteine in children with severe kwashiorkor, a type of malnutrition. Treatment with both N-acetyl cysteine and lipoic acid elicited greater antioxidant effects as indicated by changes in blood glutathione and glutathione peroxidise levels within the treatment groups when compared to control levels (Becker *et al.* 2005). A second study assessed the antioxidant effects of α-lipoic acid in the liver of rats fed a high-fat diet. Ingestion of α-lipoic acid resulted in a decrease in oxidative stress in the liver as indicated by the respective decreases in gluathione peroxidase activity when compared to control levels (Zalejska-Fiolka *et al.* 2010). This evidence suggests a role for α-lipoic acid as an antioxidant which may constitute liver protection. The NHPD (2009) recognizes α-lipoic acid as an effective supplement with a good safety profile when taken in recommended doses.

Artichoke leaf (*Cynara scolymus*) (STD 2% cynarin) 4:1 extract (equivalent to 100mg)

The artichoke has been used in traditional medicine to increase liver health (Blumenthal *et al.* 1998; Hoffman, 2003). The main phytochemical constituents found in the leaf include caffeoylquinic acids, sesquiterpene, aliphatic acids and flavonoids (Gruenwald *et al.* 2007). It is the caffeoylquinic acid derivative cynarin which is thought to elicit pharmacological activity and stimulate liver function in the form of bile secretion (Bradley, 2006). The liver contains various scavenging enzymes which function in neutralizing toxic metabolites. Studies have suggested that the artichoke leaf has an antioxidant effect and may confer liver protection by scavenging free radicals. A study by Mehmetcik *et al.* (2008) assessed the antioxidant effects of artichoke leaf extract in a hepatic necrosis model in rats. The rats were pretreated with artichoke extract 1.5/g/kg daily and then hepatic insult was chemically induced using carbon tetrrachloride. Following hepatic injury, liver enzymes levels were assessed and observed to be decreased. Endogenous antioxidant levels remained unchanged in the artichoke pretreatment group suggesting that the artichoke leaf extract was responsible for the antioxidant effect (Mehmetcik *et al.* 2008). The NHPD (2008) recognizes artichoke leaf as an effective agent to help increase bile secretion and confer liver protection. The herb has demonstrated a good safety profile when taken at recommended doses of 4.5 -10 g dried leaf equivalent/day (NHPD, 2008).

Green tea leaf extract (*Camellia sinensis*) (STD 50% polyphenols)

Green tea extract is made using the leaves from *Camellia sinensis*. In herbal medicine, these leaves have been used as an antioxidant which may help to maintain liver health. The active phytochemicals in green tea extract include caffeine, theobromine and to a small extent theophylline (Hoffman, 2003). Green tea is commonly consumed as a food, such as in laplet tea, along with other traditional Chinese dishes (Facciola, 1998). To receive positive antioxidant benefits from green tea extract, he NHPD (2008) recommends consumption of an extract which provides up to 690 mg total catechins, and no more than 150 mg caffeine daily. Studies have been conducted to assess the effects of green tea extract as an antioxidant and heptoprotectant. An *in vivo* animal study by Bruno *et al.* (2008) investigated the effects of a dietary supplement of green tea extract on liver function in leptin-deficient mice. Mice were fed a 1% green tea extract daily and a decrease in lipid levels was observed when compared to control animals. Improvements in obesity-induced hepatic injury were also observed as indicated by the normalization of liver enzyme levels (Bruno *et al.* 2008). These results suggest a role for green tea extract as a hepatoprotectant. A second study evaluated the effects green tea extract on of cadmium-induced liver damage in mice. The mice were fed cadmium and green tea extract daily for 6 months. Ingestion of green tea resulted in significant improvements in liver function and decreases in liver endogenous antioxidant enzyme activities when compared with control animals (Hamden *et al.* 2008). The described in *vitro/vivo* studies present strong evidence that green tea extract acts as an antioxidant to confer liver protection. The NHPD (2008) recognizes green tea extract as effective with a good safety profile when taken at recommended doses.

Turmeric root (*Curcuma longa*) (STD 95% curcumin) 57:1 extract (equivalent to 1425mg)

Turmeric root has traditionally been used as a choleretic (Blumenthal *et al.* 1998). The pharmacological constituent in turmeric root responsible for its choleretic properties is curcumin which acts on the gallbladder to increase bile secretion. The herb root also contains chemicals such as volatile oils and other dicinnamoylmethane derivatives (Blumenthal *et al.* 1998). An *in vivo* study was conducted to evaluate the antioxidant effects of turmeric root on chemically-induced liver injury in Sprague-Dawley rats. Following liver injury, the rats were dosed with curcumin, saikosaponin or a combination of the two phytochemicals. Following treatment, the liver and serum were assayed for enzyme activity and lipid content. The researchers observed that curcumin and saikosaponin both had positive effects on liver function and cholesterol levels, as determined by a decrease in liver fibrosis, inflammation and necrosis following treatment with the phytochemicals (Wu *et al.* 2008). Scientific evidence suggests that turmeric root may contribute to liver health. Studies have also been conducted to assess the antioxidant properties of turmeric root and how they contribute to liver health and function. In an *in vitro* study, curcumin was observed to stimulate an increase in the same liver detoxification enzymes which are induced by antioxidants. The study investigated the transcriptional regulation of these liver detoxification enzymes, and the results indicate that like antioxidants, curcumin works in a similar manner to increase the levels of detoxification enzymes within the liver (Nishinaka *et al.* 2007). Turmeric root may be an effective agent for liver protection and has demonstrated a good safety profile when taken at recommended doses of 1.5 – 3 g of daily (Blumenthal *et al.* 1998).

Ingredient Summary

Milk Thistle seed (*Silybum marianum*) (STD 80% silymarin)
- Confers liver protection

osphatidyl choline (from soy lecithin)
- Supports a healthy liver

Dandelion root (*Taraxacum officinale*) 4:1 extract (equivalent to 200 mg)
- Helps stimulate bile secretion to promote healthy liver function

L-Taurine
- Provides antioxidant properties to support liver health.

L-Methionine
- Helps to support liver function

N-acetyl cysteine
- Provides antioxidant properties to support liver health

Alpha lipoic acid
- Provides antioxidant properties which may support liver health

Artichoke leaf (*Cynara scolymus*) (STD 2% cynarin) 4:1 extract (equivalent to 100mg)
- Traditionally used to increase bile secretion and confer liver protection

Green tea leaf extract (*Camellia sinensis*) (STD 50% polyphenols)
- Provides antioxidant properties and traditionally used to support liver health

Turmeric root (*Curcuma longa*) (STD 95% curcumin) 57:1 extract (equivalent to 1425mg)
- Traditionally used to help stimulate bile secretion to promote healthy liver function

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NHPD Dandelion Monograph. http://www.hc-sc.gc.ca/dhp-mps/alt_formats/hpfb-dgpsa/pdf/prodnatur/mono_dandelion-pissenlit-eng.pdf.
NHPD Globe Artichocke Monograph. http://www.hc-sc.gc.ca/dhp-mps/alt_formats/hpfb-dgpsa/pdf/prodnatur/mono_artichoke-artichaut-eng.pdf.
NHPD Green Tea Monograph. http://www.hc-sc.gc.ca/dhp-mps/alt_formats/hpfb-dgpsa/pdf/prodnatur/mono_greentea-thevert-eng.pdf.
NHPD L-Methionine Monograph. http://webprod.hc-sc.gc.ca/nhpid-bdipsn/monoReq.do?id=191&lang=eng.
NHPD Milk Thistle Monograph. http://www.hc-sc.gc.ca/dhp-mps/alt_formats/hpfb-dgpsa/pdf/prodnatur/applications/licen-prod/monograph/mono_thistle-chardon-eng.pdf.
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PRODUCT MONOGRAPH

LiverDTX 2

(NPN 80011076)

Product composition

Medicinal Ingredients:

Each capsule contains:

Belleric myrobalan fruit (Terminalia bellerica)	100mg
Boerhavia diffusa root 11:1 extract (equivalent to 1100 mg)	100mg
Eclipta alba herb 12:1 extract (equivalent to 1200 mg)	100mg
Tinospora cordifolia stem	100mg
Andrographis paniculata leaf	50mg
Picrorhiza kurroa root	50mg

Non-medicinal ingredients: Hypromellose, water

Recommended dose: Adults: 2 capsules in the evening, on an empty stomach.

Duration of use: None

Indication: Traditionally used in Ayurvedic medicine to support liver function.

Contraindications: Do not use this product if you are pregnant or breast feeding.

Warnings: Keep out of reach of children.

Precautions: Consult a health care practitioner prior to use if you are taking blood thinning medication, have high blood pressure, and/or a heart condition.

Adverse Effects: Consult a health care practitioner if symptoms persist or worsen.

Overdose: For management of suspected product overdose it is recommended to contact your physician.

Symptoms of Overdose: Has not been investigated nor any reports have been filed.

Supporting Research and Traditional Evidence

Belleric myrobalan fruit (*Terminalia bellerica*)

In traditional Ayurvedic medicine, *Belleric myrobalan* fruit has been used as a "health-harmoniser". The fruit of *T. bellerica* has been used in the treatment of various conditions affecting the liver, vasculature system, respiratory system, skin and gastrointestinal tract. The active constituents are mainly triterpenoids, such as β- sitosterol, and polyphenols (Williamson, 2002). Studies have implicated an antioxidant activity of Belleric myrobalan fruit in the presence of tannins. A study by Soubir (2007) evaluated the antioxidant activities of a number of ethanolic plant extracts. Of the plant extracts assessed, *T. bellerica* was found to be the second most potent antioxidant, second only to *Averrhoea carambola*, commonly known as starfruit. Futhermore, a study by Chalise *et al.* (2010) investigated the effects of 15 traditionally used fruits and determined their corresponding antioxidant properties. *T. bellerica* was to be one of the most potent antioxidants when compared with the other traditional herbs and vitamin C, a known antioxidant. The only fruits to generate similar antioxidant effects were *E. officinalis* and *T. chebula* which are also traditional Ayurvedic herbs. Doses of 3 – 6 g of *T. bellerica* /day have been traditionally used for the treatment of liver disorders with an established good safety profile (Dhanoa, 2001).

***Boerhavia diffusa* root 11:1 extract**

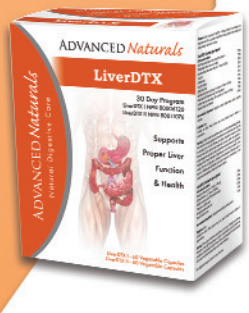
Many parts of the *Boerhavia diffusa*, also known as spreading hogweed, have been traditionally used in Ayurvedic medicine. Treatment with the herb can be beneficial to treat certain liver conditions, such as jaundice (Williamson, 2002). The major phytochemical constituents present in the root are rotenoids, lignans and xanthones (Williamson, 2002) which mediate liver health through its properties as a choleretic. Choleretic effects of *B. diffusa* have been reported in animals. Treatment with the herb produced an increase in bile flow and an increase in liver functionality following carbon tetrachloride-induced hepatotoxicity (Chandan *et al.* 1991). An *in vivo* study was performed to assess the antioxidant effects of *B. diffusa* root extract. Oxidative stress was induced chemically in albino rats. Following oxidative injury, the rats were exposed to the root extract daily for 4 weeks. Treatment with the herbal supplement resulted in a significant increase in the reduced form of many free-radical scavenging liver enzymes suggesting that *B. diffusa* extract was responsible for potent the antioxidant effects (Satheesh and Pari, 2004). Scientific evidence strongly suggests a role for *B. diffusa* as an antioxidant which contributes to liver health. Recommended effective doses with a good safety profile are 9-30 g daily (Dhanoa, 2001; Williamson, 2002).

***Eclipta alba* herb 12:1 extract**

Eclipta alba is a common weed present in India. Many parts of the plant, including the stem, roots and whole plant have been used in for the treatment of certain ailments, including hepatitis and jaundice. The main chemical constituents are triterpene glycosides, saponins, flavonoids, ecliptal, wedelic acid and sequiterpene lactone columbin. The effects of *E. alba* as a hepatoprotectant have been evaluated *in vivo*. Treatment with an ethanolic extract resulted in improvements in liver functionality in rats, as indicated by beneficial changes in serum bilirubin levels, serum transaminases and bromosulphaline clearance (Singh *et al.* 2001). Clinical evidence supports the effects of E. alba as an antioxidant. In a randomized single-blind, placebo-controlled trial, sixty hypertensive patients were treated with *E. alba* for 60 days. Treatment with *E. alba* resulted in a significant decrease in lipid peroxidation and a corresponding increase in serum antioxidant levels when compared to control-groups and baseline levels (Rangineni *et al.* 2007). These results suggest *E. alba* exhibits antioxidant effects and may contribute to liver protection. Recommended effective doses with an established safety profile are between 3-36 g of herb daily (Dhanoa, 2001; Williamson, 2002).

***Tinospora cordifolia* stem**

The stem leaves and roots of the *Tinospora cordifolia* have been used in traditional Ayurvedic medicine to treat many health conditions. The leaves have been used for the treatment of gout, and the roots have been used as an emetic. Extracts of the herb have been used to confer liver protection as well (Williamson, 2002). The active phytochemicals consist of diterpenes and alkaloids, which contribute to potent antioxidant properties of *T. cordifolia*. An antioxidant study was conducted to assess the effects of *T. cordifolia* in mice. Mice were fed butylated hydroxyanisole, a potent antioxidant, or an herbal supplement of *T. cordifolia* and a comparison of detoxifying liver enzymes activities was performed. Significant increases in detoxifying enzymes in the liver and decreases in lipid peroxidation were observed following exposure to *T. cordifolia*. In contrast, butylated hydroxyanisole significantly increased the liver detoxifying enzymes in addition to detoxifying enzymes in the forestomach, lung and kidneys (Singh *et al.* 2006). This study



suggests that *T. cordifolia* functions as an antioxidant to confer liver protection by increased detoxifying hepatic enzymes. In a randomized clinical trial, the effects of *T. cordifolia* were evaluated in patients suffering from obstructive jaundice. Thirty patients were given either a dose of 16 mg/kg/day *T cordifolia* or the conventional jaundice treatment. The results suggested that *T. cordifolia* was as effective as the conventional therapy for the treatment of jaundice (Rege *et al.* 1993). One to three grams of herb is the recommended effective dose with an established safety profile (Williamson, 2002).

***Andrographis paniculata* leaf**

Various parts of the *Andrographis paniculata* have been used in traditional Ayurvedic medicine as a remedy referred to as *kalmegh* in Hindi. In particular, the herb has been used to alleviate symptoms associated with jaundice and other liver disorders. Active phytochemicals present in the herb include several diterpenes, mainly andrographide as well as flavonoids (Williamson, 2002), which confer potent antioxidant properties and may confer liver protection in a patients with poor liver health. Scientific evidence supports the effects of *A. paniculata* as an antioxidant to confer liver protection. An *in vitro* study evaluated the antioxidant effects of the pharmacologically active constituent, andrographolide on inflammation. The results suggested that the antioxidant effects of andrographolide reduced the prevalence of reactive oxygen species and increased the functionality of cellular neutraphils (Shen *et al.* 2002). This study presents evidence for a role of *kalmegh* as an antioxidant which may confer liver protection. Furthermore, a study by Choudhury and Poddar (1984) aimed to evaluate the effects of *kalmegh* on the reduction of oxidative stress in rat liver. Oxidative stress was chemically-induced though treatment with carbon tetrachloride. The rats were given a dose of *kalmegh* extract and the prevalence of oxidative stress was measured. The results suggested that a single dose of *kalmegh* reduced the levels of chemical induced-oxidative stress as indicated by the reduction of lipid peroxidation within the rat liver. kalmegh should be taken at doses between 20-40 ml leaf extract twice a day for efficacious results with an established safety profile (Williamson, 2002).

***Picrorhiza kurroa* root**

The dried root and rhizome of *Picrorhiza kurroa* have been implicated in traditional Ayurvedic medicine, particularly for the treatment of jaundice and other liver disorders. The root contains various iridoid glycosides, cucurbitacin glycosides and phenolic compounds which pharmacologically promote liver health. Clinical studies haven been conducted to assess the effects of *P. kurroa* root in the treatment of certain liver disorders. A randomized, double-blind trial was conducted to assess the effects of *P. kurroa* as a hepatoprotectant. Patients suffering from viral hepatitis received either *P. kurroa* root or placebo 3 times a day for 2 weeks. Throughout the treatment regimen, liver function parameters were analyzed. Following 7 days of treatment, a significant reduction was observed for serum bilirubin levels when compared to the placebo-controlled group. Significant decreases in serum transaminase levels were also observed after 7 days of treatment with the root. The effects of the herb were lasting and levels were altered beneficially even at the end of the study (Vaidya *et al.* 1996). This study suggests *P. kurroa* root can function as a hepatoprotectant with a good safety profile when taken at recommended doses between 1-1.5 g of root/day (Williamson, 2002).

Ingredient Summary

Belleric myrobalan fruit (*Terminalia bellerica*)
- Provides antioxidant properties and traditionally used in Ayurveda to support liver health

***Boerhavia diffusa* root 11:1 extract**
- Traditionally used in Ayurveda for liver protection

***Eclipta alba* herb 12:1 extract**
- Provides antioxidant properties and traditionally used to support liver health

***Tinospora cordifolia* stem**
- Provides antioxidant properties and traditionally used to support liver health

***Andrographis paniculata* leaf**
- Provides antioxidant properties and traditionally used to support liver health

***Picrorhiza kurroa* root**
- Traditionally used in Ayurveda to support liver health

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