

Standardised Bilberry Extract: Focus on Microcirculation & Eye Health

Key Points at a Glance

Bilberry

- reputation during second world war for improving night vision; research began for effects on vision and vascular disorders
- traditionally used in gastrointestinal disorders and inflammation and venous insufficiency
- key constituents are the anthocyanins
 - blue pigments structurally related to flavonoids, responsible for the colour of ripe fruit
 - content varies and adulteration can occur; sophisticated testing required to confirm authenticity
- animal studies show Bilberry improves capillary permeability and microcirculation; vasoprotective activity may be partly due to a stabilising effect on collagen

Clinical Applications

- Peripheral circulation disorders; venous insufficiency, venous disorders during pregnancy, including haemorrhoids.
- Symptoms caused by decreased capillary resistance or increased capillary fragility.
- Retinopathies; postoperative complications of minor surgery.
- As part of a protocol or treatment regimen to benefit microcirculation and endothelial health.
- Visual fatigue, eye strain, normal tension glaucoma; vision disorders due to altered microcirculation of the retina, including myopia and possibly to improve night vision.
- Adjunctive treatment for cardiovascular disease and to support cardiovascular health.

Actions

Vasoprotective, antioedema, supporting microcirculation, antioxidant.

Safety

Caution in patients taking antiplatelet or anticoagulant drugs, and for high doses in patients with haemorrhagic disorders.

Clinical Studies

microcirculation, vascular integrity

- generally improved signs, symptoms and some microcirculation parameters in retinopathies (extract providing 57.6-180 mg/day of anthocyanins), for example:
 - improved retinal haemorrhage, but mixed results for hard exudates, in diabetic retinopathy
 - improved ocular blood flow in hyperflow and ischaemic retinopathies
- improved symptoms and some microcirculation parameters in venous insufficiency and varicose veins (most often extract providing 173 mg/day of anthocyanins), although effects not demonstrated recently in those with moderate-severe condition
- uncontrolled early studies found therapeutic activity for the treatment of peripheral vascular disorders and conditions characterised by capillary fragility
- best results probably achieved in the early stage of the disease, by prolonged and high-dose treatment, with full-spectrum extracts

other effects on the eyes

- relieved subjective and objective measures of eye strain/fatigue (extract providing ~ 40-70 mg/day of anthocyanins)
- improved severe symptoms of dry eye (extract providing 57.6 mg/day of anthocyanins)
- improved visual function in normal tension glaucoma (extract providing 120 mg/day of anthocyanins)

other effects

- cardiovascular activity:
 - improved lipid profiles in healthy volunteers (fruit providing 1367 mg/week of anthocyanins)
 - improved ApoA-I levels in dyslipidaemia (isolated anthocyanins, 99% from Bilberry; 80 mg/day)
 - many trials/actions using high doses of isolated anthocyanins, 99% from Bilberry (320 mg/day) e.g. improved endothelium-dependent vasodilation in hypercholesterolaemic patients
- preliminary antioxidant effect in dry eye (extract providing 57.6 mg/day of anthocyanins); improved one antioxidant measure in dyslipidaemia (isolated anthocyanins, 99% from Bilberry; 80 mg/day)
- relieved dysmenorrhoea (extract providing 115 mg/day of anthocyanins)

Botanical Name:	<i>Vaccinium myrtillus</i>
Family:	Ericaceae
Part Used:	Fruit

Following the use of Bilberry jam by RAF pilots during the second world war to improve their night vision, scientists began investigating the effects of the Bilberry and its anthocyanins on vision and vascular disorders.

Bilberry fruit has been used in traditional western herbal medicine particularly for diarrhoea, dyspepsia, haemorrhoids and inflammation of the mouth, throat and gastrointestinal tract. Traditional use in France includes capillary fragility and venous insufficiency (oral and topical use).^{1,7}

Key constituents of Bilberry fruit are the anthocyanins (also known as anthocyanosides). These are blue pigments structurally related to flavonoids and are responsible for the colour of the ripe fruit. During the later stages of ripening, the content of anthocyanins increases strongly, and they become the major flavonoids in the ripe fruit.³ The anthocyanins are mainly present as glucosides, galactosides and arabinosides of delphinidin, cyanidin, and to a lesser extent, malvidin, petunidin and paeonidin. However, there can be differences, for example, glucosides are also almost completely absent in fruit from Eastern Finland.⁴

The level of anthocyanins can vary in the fresh fruit and in Bilberry products.^{5,6,7,8,9} To detect adulteration by food dye or other species, sophisticated testing such as high performance liquid chromatography (HPLC) is required, rather than non-specific test methods such as spectrophotometry.^{4,10} (Spectrophotometric methods are appropriate for quantification of total anthocyanins, but not to detect adulteration.⁴)

Other constituents of Bilberry fruit include flavonols and other phenolic compounds.⁴

Microcirculation & Vascular Integrity

The largest part of our circulatory system is the microcirculation, which is the network of arterioles, capillaries and venules. The health of the microcirculation determines the blood supply and nutrient flow to body tissues, particularly to the retina of the eye, glomeruli of the kidney and the long nerves that flow out of the spine.¹¹

Animal studies indicate that Bilberry extract improves capillary permeability and microcirculation. Many of these studies administered extracts or anthocyanins by injection or by very high oral doses, but the effect has been confirmed with more modest oral doses.¹² For example, Bilberry extract reduced microvascular impairments due to experimentally-induced ischaemia in hamsters, by reducing the increase in capillary permeability and decreasing leukocyte adhesion.^{12,13} Using allometric scaling, the dose corresponded to about 340 mg/day of anthocyanins in a 70-kg human.

The vasoprotective activity may be partly due to a stabilising effect on collagen.¹⁴

The utility of Bilberry, in improving vascular integrity and microcirculation is illustrated in the following clinical studies of retinopathies and venous insufficiency where beneficial effects on the signs, symptoms and some parameters of microcirculation are demonstrated. Best results are probably achieved in the early stage of the disease, by prolonged and high-dose treatment, with full-spectrum extracts.

Recent Clinical Studies

A registry (observational) study evaluated two Bilberry extracts in patients with different types of retinopathy. There were 47 and 55 patients who received Bilberry as well as standard management, and 38 patients had standard management only (and served as the control group). Standard management comprised salt and caffeine restriction, physical exercise, regular diet and sleep and control of risk factors. Diabetics were not using insulin, and patients with hypertension were treated with single angiotensin-converting enzyme inhibitors. The two Bilberry extracts provided the same dose of anthocyanins (57.6 mg/day). One extract was said to contain the full range of non-anthocyanin components, while the other was a highly purified anthocyanin-rich extract. Patients were assessed after 6 months of treatment for the effect on retinal circulatory parameters, as well as signs/symptoms. Based on ocular blood flow patterns, patients were divided into two subgroups: (1) proliferative and nonproliferative retinopathy (hyperflow; with increased systolic and diastolic flows) and (2) post-thrombotic, hypertensive, glaucoma and ischaemic retinopathy (ischaemic; with decreased systolic and diastolic flows). See *Table 1 for results*.¹⁵

An uncontrolled study conducted in Italy investigated the retino-cortical bioelectrical activity in 9 type 2 diabetic patients with severe preproliferative retinopathy. There was good glycaemic control in the patients and they received standardised Bilberry extract (115 mg/day of anthocyanins) for one month. The effect of Bilberry was investigated using the non-invasive visual evoked potential (VEP) test that measures the electrophysiological response of the nervous system to visual stimuli. At the end of treatment, 4 of the 9 patients recorded improvement in, and a normalisation of, VEP response (P100 amplitude and waveform). The authors suggest that these preliminary results may recommend standardised Bilberry extract treatment to help prevent the worsening of diabetic retinopathy.¹⁶

Another registry study involved patients with varicose veins and chronic venous insufficiency. Treatment with standardised Bilberry extract (216 mg/day of anthocyanins) for a period of at least one year, did not have significant effects on microcirculation measures or signs/symptoms. Patients had varicose veins, present for more than 5 years and their signs/symptoms were rated as moderate to severe at inclusion. Seventy-seven patients received Bilberry extract.¹⁷ It may be preferable to begin treatment with Bilberry extract at an earlier stage in the condition.

A prospective, uncontrolled study in Korea found contrast sensitivity significantly improved in patients with diabetic retinopathy after one year's treatment with standardised Bilberry extract. There were no significant changes in the numbers of hard exudates, microaneurysms, and leaking points. Eighty-eight patients were enrolled in the study and 175 eyes were assessed.¹⁸ The dose contained 180 mg/day of anthocyanins.¹⁹

Significant improvement ($p < 0.05$) from baseline and compared to the control group for both Bilberry groups occurred for: <ul style="list-style-type: none"> retinal haemorrhage, hard exudates arteriolar vasoconstriction atherosclerosis 	Scores for the following parameters were significantly improved ($p < 0.05$) from baseline and compared to the control group for both Bilberry groups: <ul style="list-style-type: none"> oedema blurring of vision
There was significant improvement ($p < 0.05$) in ocular blood flow velocity from baseline and compared to the control group for both Bilberry groups in the ischaemic subgroup.	
There were additional, statistically significant improvements demonstrated for those receiving the full-spectrum Bilberry extract compared to baseline and the control group, specifically: <ul style="list-style-type: none"> capillary microaneurism, soft exudates, arteriovenous crossing eye flow score[†] ocular blood flow velocity in the hyperflow subgroup 	
The full-spectrum extract produced significantly better results for almost all symptoms/signs, parameters and for ocular blood flow in both subgroups, compared with the highly purified anthocyanin-rich extract. This suggests that, in addition to the anthocyanins, the other components of Bilberry fruit contribute to the therapeutic activity.	
Visual acuity was not improved. In diabetic participants, fasting blood glucose and mean HbA1c did not significantly change over the course of the treatment, and neither did intraocular pressure in patients with glaucoma.	

Examples of Statistically Significant Results

Sign, Symptom or Parameter	Bilberry (full) + Std		Bilberry (rich) + Std		Std	
	Baseline	6 months	Baseline	6 months	Baseline	6 months
oedema*	19	12	21	18	18	16
retinal haemorrhage*	8	6	10	7	8	9
hard exudates*	9	2	7	3	7	7
oedema (score) [†]	1.8	1.1	1.8	1.5	1.7	1.7
blurring (score) [†]	2.0	1.2	2.2	1.6	2.1	2.0
ocular blood flow (cm/s; ischaemic subgroup)	16	23	17	19	17	17

Table 1. Summary of results for patients with retinopathy treated with two Bilberry extracts in an observational study.

- Abbreviations:** Bilberry (full): full-spectrum Bilberry extract; Bilberry (rich): highly purified anthocyanin-rich Bilberry extract; HbA1c: glycosylated haemoglobin; Std: standard management.
- Notes:** [†] Classified with an arbitrary scale, ranging from 0 to 3, based on clinical observation: 0 = normal; 1 = minimal alterations; 2 = important alterations; 3 = severe alterations. * Likely refers to the number of patients with this symptom/sign, or the number of symptoms/signs in the group.

Early Clinical Studies

Uncontrolled trials performed in Europe dating from the early 1960s showed Bilberry extract to have good therapeutic activity for the treatment of peripheral vascular disorders and conditions characterised by capillary fragility. The efficacy of the extract in those with **capillary fragility** secondary to pathological conditions such as diabetes, atherosclerosis or hypertension, appeared to be linked to early and prolonged treatment at high doses.¹²

A review of uncontrolled trials (1979–1985) for patients with venous insufficiency of the lower limbs concluded that standardised Bilberry extract reduced symptoms, especially in regard to **improving microcirculation and lymph drainage**.²⁰ Many trials administered standardised Bilberry extract at a dose that provided 173 mg/day of anthocyanins.²¹

Several placebo-controlled trials (1980s) were carried out using standardised Bilberry extract. The following results show improvement for the treatment group from baseline values.

- Significant reduction in the severity of symptoms, including pain and oedema, occurred in patients with **venous insufficiency** (dose contained 173 mg/day of anthocyanins; taken for 30 days).²²

- Paraesthesia, oedema and heaviness were reduced in patients with **peripheral vascular disorders** (dose contained 173 mg/day of anthocyanins; taken for 30 days).²³
- Improvement in hard exudates, which is indicative of increased permeability of retinal blood vessels, was observed in early-phase diabetic retinopathy (dose contained 115 mg/day of anthocyanins; taken for 12 months).²⁴
- Improvements in ophthalmoscopic and angiographic findings were observed in diabetic or hypertensive retinopathy (dose contained 115 mg/day of anthocyanins; taken for one month).²⁵

In uncontrolled trials (1980s-1990), standardised Bilberry extract:

- reduced signs and symptoms in pregnant women with venous insufficiency or haemorrhoids (dose contained 57-173 mg/day of anthocyanins; taken for 3 months);²⁶
- reduced the microcirculatory changes** caused by cortisone treatment in patients with asthma and chronic bronchitis (dose contained 173 mg/day of anthocyanins; taken for 10-30 days);²⁷
- reduced retinal haemorrhage, and improved the condition, in 10 patients with diabetic retinopathy (dose contained 173 mg/day of anthocyanins; taken for 6 months);²⁸
- reduced postoperative symptoms and complications from minor surgery, including itch and oedema (doses contained 115-173 mg/day of anthocyanins).^{29,30}

Other Effects on Eyes

Eye Strain/Fatigue

Bilberry extracts have been used in Japan to relieve eye strain,³¹ although few details are available. For example, a double-blind, placebo-controlled trial, published in 1998, involving 20 patients with asthenopia (eye strain), found significant improvement in those treated with Bilberry for 6 of 10 symptoms. Symptoms did not improve in those taking placebo. Bilberry also **improved general fatigue** and flicker values more significantly than did placebo. Treatment duration was 8 weeks and the dose was 62.25 mg/day of *Vaccinium myrtillus* anthocyanins,³² presumably provided as an extract rather than as isolated constituents.

More recently, several small studies, published in 2015 and 2017, established that standardised Bilberry extract could **improve eye fatigue** caused by using visual/video display terminal (VDT) devices. A further trial was conducted to investigate the response to longer consumption of the extract (12 weeks), and measured ciliary muscle contraction of the eye, which is an objective measure of eye fatigue. The randomised, double-blind, placebo-controlled trial enrolled healthy men and women aged 20-60 years whose jobs involved VDT tasks and who had subjective symptoms of eye fatigue. The standardised Bilberry extract provided 70 mg/day of anthocyanins. Ninety-seven people completed the testing. Bilberry relieved the tonic accommodation of the ciliary muscle compared to baseline, and to placebo group at week 8 and week 12.³³ Although this trial did not assess subjective symptoms, in one of the earlier studies (2015), subjective symptoms of eye fatigue were relieved after taking standardised Bilberry extract for 4 weeks.³⁴

The results of two other trials investigating eye fatigue are summarised in Table 2.

A 2021 randomised, double-blind, placebo-controlled trial confirmed that treatment with standardised Bilberry extract (providing 43.2 mg/day of anthocyanins) **inhibited the decline in accommodative function** caused by VDT use. Thirty healthy Japanese workers completed the 6-week trial. There were no significant effects on subjective symptoms, the amount of lacrimal fluid or the hardness of shoulder muscles.³⁷

Myopia & General Vision

Treatment with standardised Bilberry extract improved electrophysiological responses in those with myopia.³⁸

Although a number of studies conducted from the 1960s suggested that standardised Bilberry extracts improve vision in conditions of reduced light, more recent and rigorous trials did not confirm the activity.³⁹

Other Conditions

Twenty-one otherwise healthy volunteers suffering from dry eye symptoms completed a randomised, double-blind trial in which they received standardised Bilberry extract (providing 57.6 mg/day of anthocyanins) or placebo for 4 weeks. To reproduce the conditions of visual load by VDT use, participants were instructed to play on a video game console for 45 minutes before examination. The volume of tear secretion was significantly improved in the Bilberry extract group, whereas no significant changes were observed in the placebo group. A subgroup analysis revealed that the **improvement rate was significantly higher in those with severe symptoms of dry eye** compared to participants with milder symptoms, who were treated with Bilberry. This did not occur in the placebo group.⁴⁰

A retrospective study was performed to evaluate visual function in patients with normal tension glaucoma. The study, conducted in Korea, comprised 132 patients treated with Bilberry, 103 with Ginkgo and 97 in the control group (who received no treatment). The mean follow-up duration was 23.82 months. The daily dose of Bilberry extract provided 120 mg/day of anthocyanins. *Ginkgo biloba* leaf extract, said to contain ginkgo flavone glycosides and terpene lactones, was prescribed at a dose of 160 mg/day.⁴¹

- **Visual acuity was significantly improved** from baseline for the Bilberry group, whilst there was no effect for Ginkgo treatment and the control group had significantly worse results.
- Mean deviation of visual field significantly improved with Bilberry and Ginkgo treatments.

Other Cardiovascular Activity

Many trials have investigated the effect on risk factors of cardiovascular disease in patients and volunteers. Generally, very high doses of fresh fruit, juice or isolated anthocyanins have been administered, and the results are not consistent.

A few trials have administered more modest doses.

A study investigated the effect of consuming Bilberries on cardiovascular disease risk factors. Healthy volunteers added to their diet, 150 g of frozen Bilberries 3 times per week. They were asked not to change either their eating habits or their lifestyle for the 6-week study. Thirty-six people (25 women, 11 men) completed the intervention. The anthocyanin content of the fruit was analysed, with the weekly dose providing 1367 mg,⁴² which, spreading this dose equally, is about 195 mg/day of anthocyanins.

- Compared to baseline, the consumption of Bilberries led to significant decreases in total cholesterol, LDL-cholesterol, triglyceride, and an increase in HDL-cholesterol. *See table on next page.*

Trial Details	Dose	Results	Ref
r, db, pc; n = 22	120 mg/day of extract, providing 43.2 mg/day of anthocyanins;* for 6 weeks	<ul style="list-style-type: none">• significant improvement in amount of tears, accommodative function of the eye and sensation of eye fatigue compared to the placebo group• significant reduction in accumulative eye fatigue (as measured by critical flicker frequency) compared to the placebo group	35
r, db, pc; n = 21	160 mg/day of extract, providing 57.6 mg/day of anthocyanins;* for 6 weeks	<ul style="list-style-type: none">• significant improvement in accommodative function of the eye, eye dryness, eye fatigue (objective and subjective assessments) and neck and shoulder stiffness, compared to the placebo group	36

Table 2. Treatment of VDT-induced eye fatigue by standardised Bilberry extract evaluated in two Japanese trials (2016, 2017).

1. **Abbreviations:** db: double-blind; n: number of volunteers in the study; pc: placebo-controlled; r: randomised; VDT: visual/video display terminal
2. **Notes:** * Dose of anthocyanins derived from subsequent information on the brand of the product.

- Generally, **lipid profiles improved** e.g. the percentage of women with high total cholesterol values (≥ 239.8 mg/dL) decreased from 27.8% to 16.5%, and for men, from 14.4% to 0%. The percentage with high LDL-cholesterol values (162.4-189.5 mg/dL) decreased from 27.8% to 11.2% (women) and from 42.8% to 14.3% (men).
- Blood glucose was also significantly decreased: from 97.7 to 88.6 mg/dL (women), and from 107.5 to 90.9 mg/dL (men).

	Baseline	After Consuming Bilberries
Women		
total cholesterol (mg/dL)	225.1	200.7
LDL-cholesterol (mg/dL)	132.3	114.1
triglycerides (mg/dL)	138.2	87.7
HDL-cholesterol (mg/dL)	138.2	87.7
Men		
total cholesterol (mg/dL)	207.3	191.0
LDL-cholesterol (mg/dL)	117.9	107.9
triglycerides (mg/dL)	149.7	123.1
HDL-cholesterol (mg/dL)	47.2	57.6

Isolated Anthocyanins

Although full-spectrum extracts may provide the best therapeutic activity, isolated anthocyanins have been shown to be beneficial. Anthocyanins isolated from the fruit skins of Bilberry and Blackcurrant (*Ribes nigrum*) are one product that has been clinically evaluated. The combination consists of 15 anthocyanins from Bilberry, and four from Blackcurrant, although two of the latter are also found in Bilberry. The combination consists of 99% anthocyanins found in Bilberry (and 1% of the two anthocyanins found in Blackcurrant but not Bilberry),⁴³ although the proportions of the anthocyanins in this product are different to what is usually found naturally in fruit. For example, the glucosides, galactosides and arabinosides of delphinidin can make up about 34.2% of the main anthocyanins present in fresh Bilberry fruit,⁴⁴ and in the combination product, these anthocyanins account for 58.0%.⁴³

A placebo-controlled trial found that treatment with these isolated anthocyanins (80 mg/day) for 12 weeks significantly **improved ApoA-I levels in patients with dyslipidaemia**, compared to placebo. Apolipoprotein A-I is the most important structural protein of HDL. The results did not reach statistical significance at 6 weeks at this dose, suggesting longer treatment is required. The results were not significant at the lower dose (40 mg/day) compared to placebo, although there were significant increases from baseline at both 6 and 12 weeks. HDL-cholesterol levels did not significantly increase. Dietary habits and physical activity during the trial did not substantially change. Forty-five and 42 patients completed the study in the 40-mg/day and 80-mg/day groups, respectively.⁴⁵

Many controlled trials have evaluated the cardiovascular activities of this isolated anthocyanin combination, often using a dose of 320 mg/day. For example, at this dose, the anthocyanins strongly, and with statistical significance, improved endothelium-dependent vasodilation in patients with hypercholesterolaemia. One hundred and forty-six individuals completed the placebo-controlled, 12-week study.⁴⁶

Antioxidant & Anti-inflammatory Effects

Antioxidant activity has not been consistently demonstrated in studies with patients and diabetics, even when high doses are administered or physiologically relevant parameters have been measured.

At much more moderate doses, the placebo-controlled clinical study involving patients with dry eye mentioned above, found that treatment with Bilberry extract (providing 57.6 mg/day of anthocyanins) for 4 weeks, had some antioxidant effects. Specifically, it improved a measure of antioxidant potential in plasma.⁴⁰ More rigorous tests are needed.

The isolated anthocyanins combination, at a dose of 80 mg/day taken for 12 weeks, significantly decreased one measure of oxidative stress (urinary 8-iso-prostaglandin F_{2α}) but not two others (urinary 8-hydroxy-2'-deoxyguanosine, serum malonaldehyde) in patients with dyslipidaemia.⁴³

Conflicting results have been observed in patients regarding the effect on blood levels of inflammatory markers or measures of acute inflammation, even at high doses. The anti-inflammatory activity of Bilberry anthocyanins demonstrated in animal studies against oedema may be related to their vasoprotective activity.¹²

Other Activity

In a placebo-controlled trial, standardised Bilberry extract significantly **reduced symptoms of dysmenorrhoea** (breast pain, back pain, headache, nausea, heaviness of the lower limbs) from baseline. The dose contained 115 mg/day of anthocyanins and was taken for 3 days before and during the cycle. Only headache was significantly improved in the placebo group. A total of 30 women participated in the study.⁴⁷

Some unexpected adverse results were found in a small, placebo-controlled study that involved runners completing a half marathon. There were small to moderate *increases* in exercise-induced delayed onset muscle soreness and inflammation (C-reactive protein) found from ingestion of Bilberry juice (providing 160 mg/day of anthocyanins). The test and placebo beverages were consumed for 5 days prior to the marathon, on the day of competition and for 2 days after the race. Further larger studies are required to verify and/or understand the implications of these results.⁴⁸

Safety

Caution is warranted for high doses of extract (> 80 mg/day anthocyanins) in patients with haemorrhagic disorders and those taking antiplatelet or anticoagulant drugs.

The evidence for this recommendation follows.

- Inhibition of platelet aggregation has been demonstrated *ex vivo* in a study involving 30 healthy volunteers who consumed Bilberry extract (providing 173 mg/day of anthocyanins for 30-60 days).⁴⁹
- There is a case report of postoperative bleeding (Bilberry extract undefined).⁵⁰
- High doses combined with vitamin C (600 mg/day of Bilberry anthocyanins + 30 mg/day of vitamin C for 2 months then reduced to maintenance dose) were found to reduce retinal haemorrhage without impairing coagulation in 9 patients taking anticoagulant drugs.⁵¹

- The combination of anthocyanins isolated from Bilberry and Blackcurrant (*discussed in Other Cardiovascular Activity above*) significantly reduced collagen-induced platelet aggregation at doses of 80, 160 and 320 mg/day, and ADP-induced platelet aggregation (160 and 320 mg/day) compared to placebo when taken for 12 weeks, but not 6 weeks, in patients with dyslipidaemia. The decrease in collagen-induced platelet aggregation at 12 weeks from baseline for 80 mg/day was -3.4%. Inhibition did not occur at the lower dose of 40 mg/day. There was no effect on measures of coagulation, such as prothrombin time. There were approximately 20 patients in each dose group.⁵² In 26 healthy volunteers, this combination (320 mg/day) taken for 28 days significantly decreased ADP-induced platelet aggregation from baseline, but did not influence clotting times for prothrombin time and activated partial thromboplastin time.⁵³ Two double-blind, placebo-controlled, crossover studies involving healthy volunteers and overweight/obese individuals have found that this dose, administered for 28 days, inhibited platelet aggregation in some, but not all test models.^{54,55}

Actions

Vasoprotective, antioedema, supporting microcirculation, antioxidant.

Clinical Applications

- Peripheral circulation disorders; venous insufficiency, venous disorders during pregnancy, including haemorrhoids.
- Symptoms caused by decreased capillary resistance or increased capillary fragility.
- Retinopathies; postoperative complications of minor surgery.
- As part of a protocol or treatment regimen to benefit microcirculation and endothelial health.
- Visual fatigue, eye strain, normal tension glaucoma; vision disorders due to altered microcirculation of the retina, including myopia and possibly to improve night vision.
- Adjunctive treatment for cardiovascular disease and to support cardiovascular health.

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