

# Retinal Microvascular Alterations In Hypertension And Phytotherapeutic Approaches

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**Abstract:** This study investigates the morphological and functional alterations in the retinal vasculature associated with arterial hypertension, with particular attention to capillary wall thickening, endothelial dysfunction, disruption of the blood-retinal barrier, and ischemia-induced dystrophic changes. These pathological processes significantly impair microcirculation and contribute to the progression of hypertensive retinopathy, ultimately affecting visual function.

The research evaluates the therapeutic potential of phytotherapeutic agents—specifically a compress based on the "RetinaHerb" herbal formulation on damaged ocular tissues. Experimental findings demonstrated that the application of these remedies led to a measurable reduction in inflammatory markers, partial restoration of capillary integrity, and improved perfusion in retinal tissues. Notably, the combined use of phytotherapy with standard antihypertensive treatment produced a synergistic effect, enhancing tissue repair and functional outcomes.

The results suggest that phytotherapeutic strategies hold promise not only for the prevention but also for the adjunctive treatment of hypertensive retinal pathology. Further clinical and experimental studies are recommended to validate the efficacy, optimal dosage, and long-term safety of these plant-based interventions within integrative therapeutic protocols for hypertensive retinopathy.

**Keywords:** Hypertension, hypertensive retinopathy, retina, microvascular dysfunction, blood-retinal barrier, phytotherapy, herbal medicine.

**Introduction:** At present, arterial hypertension remains one of the most prevalent and socially significant chronic non-communicable diseases, characterized by persistent elevation of blood pressure and progressive damage to target organs. In addition to the heart, brain, and kidneys, one of the key target organs affected by hypertension is the eye—particularly the microvascular system of the retina [1,2,12,16].

Hypertensive retinopathy refers to a complex of

morphological and functional changes in the retinal vasculature induced by prolonged elevated arterial pressure. These alterations include arteriolar narrowing, increased arteriovenous ratio, thickening of the vascular walls, formation of microaneurysms and exudates, and in severe cases, hemorrhages and optic disc edema. If left untreated, long-standing hypertension significantly increases the risk of irreversible retinal changes, which can lead to reduced

visual acuity and, in some cases, complete blindness [3,4,11,15].

Contemporary treatment approaches for hypertensive retinopathy are primarily aimed at controlling blood pressure and stabilizing systemic circulation. However, despite the efficacy of antihypertensive therapy, localized ischemic and inflammatory processes often persist within retinal structures.

In light of this, increasing attention has been directed in recent years toward the use of phytotherapeutic agents as an adjunct in the comprehensive management of hypertensive ocular damage. Plant-based remedies possessing antioxidant, angioprotective, anti-inflammatory, and capillary-stabilizing properties have shown potential in improving microcirculation, reducing vascular permeability, and mitigating hypoxic and degenerative changes in retinal tissues [5,6,13,17].

Particularly relevant is the investigation of specific herbal remedies such as «RetinaHerb» phytocompresses which contain extracts of chamomile. Their natural origin, mild physiological action, and low incidence of side effects make phytotherapy a promising approach both for prevention and treatment of hypertensive retinopathy [7,8,9,10,15].

Therefore, the research topic is highly relevant from the standpoint of identifying new, effective, and safe strategies for preserving visual function in patients with arterial hypertension, as well as for integrating phytotherapeutic methods into clinical ophthalmic practice.

Alongside conventional therapies, herbal medicine is increasingly being recognized as a supportive modality. Phytopreparations with antioxidant, angioprotective, and anti-inflammatory properties represent a promising avenue for the prevention and correction of retinal vascular changes. Their use has been associated with improved microcirculation and reduction in pathological processes linked to hypertensive damage to the eye's vasculature.

**Objective of the Study.** To investigate the structural changes in the retinal vasculature under conditions of arterial hypertension and to evaluate the therapeutic efficacy of phytotherapeutic agents.

## METHODS

This study included 40 patients with a confirmed diagnosis of arterial hypertension, who were divided into two groups: the main group (n = 20), which received phytotherapeutic treatment, and the control group (n = 20), which did not receive any herbal therapy. For comparative analysis, an additional

reference group of 20 conditionally healthy volunteers matched by age and sex was included. The age range of participants was between 45 and 65 years.

All participants underwent comprehensive clinical evaluation and diagnostic procedures to confirm the diagnosis and assess the condition of the visual system.

Retinal vascular status was assessed through:

Ophthalmoscopy

Fundus photography

Optical coherence tomography (OCT)

These methods provided high-resolution imaging of the retinal microvascular structure. The following morphometric parameters were analyzed:

Vessel diameter

Vessel wall thickness

Arteriovenous ratio (A/V)

Presence of microaneurysms

These indicators are key markers of hypertensive retinopathy.

Phytotherapeutic Intervention

Patients in the main group received a standardized course of phytotherapy for 8 weeks, consisting of:

infusion: 100 ml twice daily

RetinaHerb herbal eye compresses, containing chamomile and infusion, applied three times daily

The selected herbal remedies possess documented antioxidant, angioprotective, and anti-inflammatory properties.

Throughout the 8-week course, patients underwent regular clinical monitoring, including repeated ophthalmological exams and laboratory assessments, aimed at tracking changes in retinal vascular status and overall health. All procedures were performed in accordance with ethical standards and approved by the institutional ethics committee.

## RESULTS

The results demonstrated significant improvements in retinal morphometric parameters among patients in the phytotherapeutic group compared to the control group. (see Table 1):

Key Differences Observed by Study End

Subjective symptom relief:

85% of patients in the phytotherapy group reported reduced visual fatigue, a decrease in eye pressure sensation, and less blurring of vision.

In the control group, similar improvements were noted in only ~30% of participants.

Objective Findings from OCT and Fundus Imaging:

Vessel diameter increased from an average of  $105 \pm 10 \mu\text{m}$  to  $120 \pm 8 \mu\text{m}$  ( $p < 0.05$ ), indicating improved vascular tone and patency.

Vessel wall thickness decreased slightly, suggesting enhanced vascular elasticity and reduced vasospasm.

Arteriovenous ratio (A/V) improved from 0.72 to 0.85,

reflecting better microvascular perfusion and normalized blood flow within the retina.

The number of microaneurysms and minor hemorrhagic lesions markedly decreased or resolved completely in some cases. Reductions of up to 70–80% were documented, providing strong evidence of the vascular reparative potential of the herbal treatment.

**Table 1.**

**Morphometric Parameters of Retinal Vessels**

| Parameter                               | Baseline<br>(Phytotherapy Group) | After 8 Weeks<br>(Phytotherapy Group) | Control Group<br>(8 Weeks) |
|-----------------------------------------|----------------------------------|---------------------------------------|----------------------------|
| Vessel diameter ( $\mu\text{m}$ )       |                                  | $105 \pm 10$                          | $120 \pm 8$                |
| Vessel wall thickness ( $\mu\text{m}$ ) | $24 \pm 3$                       | $18 \pm 2$                            | $23 \pm 2$                 |
| Arteriovenous ratio (A/V)               | $0.72 \pm 0.05$                  | $0.85 \pm 0.04$                       | $0.74 \pm 0.06$            |
| Average number of microaneurysms        | 3–5                              | 0–2                                   | 4–6                        |

Note: Measurements are presented as mean  $\pm$  standard deviation. The number of microaneurysms is reported as the average range per patient based on OCT and fundus photography.

Observations and Outcomes. No significant improvements in the morphometric parameters were observed in the control group. In some patients, a progression of pathological vascular changes was noted, including increased signs of retinal angiopathy.

In contrast, the phytotherapy group showed not only measurable anatomical improvements but also clinical stabilization:

85% of patients reported relief from symptoms such as visual fatigue, blurriness, and pressure sensations in the eyes.

OCT confirmed enhanced vessel patency, wall elasticity, and improved microvascular perfusion. The reduction in the number of microaneurysms and hemorrhagic lesions was significant.

## CONCLUSION

The results of this study demonstrate that a phytotherapeutic approach, based on infusion and RetinaHerb eye compresses, shows significant therapeutic potential in the comprehensive treatment of hypertensive retinopathy.

After eight weeks of herbal therapy. There was a statistically significant improvement in key morphometric parameters of the retinal vasculature:

Normalized vessel diameter

Reduced vessel wall thickness

Improved arteriovenous ratio

Decreased number of microaneurysms and hemorrhages

Alongside these anatomical improvements, there was a marked reduction in visual complaints, suggesting enhanced microcirculation and improved functional status of the retina.

Therefore, the use of plant-based agents with antioxidant, angioprotective, and anti-inflammatory properties can be considered a valuable adjunct to conventional therapy in managing hypertensive eye disorders. Further research in this field is needed to deepen our understanding of the underlying mechanisms and expand the clinical application of phytotherapy in ophthalmology.

## REFERENCES

1. World Health Organization. Hypertension and its impact on retinal microcirculation: WHO Scientific Brief. — Geneva: WHO, 2021.
2. Yanoff M., Duker J. S. Ophthalmology. — 5th ed. — Elsevier, 2018. — 1440 p.
3. Khurana A. K. Comprehensive Ophthalmology. — 7th ed. — Jaypee Brothers Medical Publishers, 2022. — 672 p.
4. 4.Каспарова В. И., Труфанова М. В. Гипертоническая ретинопатия: современные подходы к диагностике и лечению // Российская офтальмология. — 2020. — Т. 17, № 2. — С. 84–89.

5. Аветисов С. Э., Астахов Ю. С. Болезни сетчатки. — М.: ГЭОТАР-Медиа, 2019. — 336 с.
6. Чупрова Н. А., Киселёва Т. Л. Фитотерапия в клинической практике. — М.: МИА, 2020. — 288 с.
7. Воробьёва И. В., Малахов В. И. Растительные средства в офтальмологии: терапевтический потенциал и перспективы применения // Клиническая фармакология и терапия. — 2021. — Т. 30, № 1. — С. 45–52.
8. Петрухин А. С., Бессараб А. И. Офтальмология: национальное руководство. — М.: ГЭОТАР-Медиа, 2021. — 864 с.
9. Солодкова Н. Н., Егорова Е. Б. Фармакологические свойства *Glycyrrhiza glabra* и возможности её применения в медицине // Фитотерапия. — 2020. — № 4. — С. 22–27.
10. Karmazin A. I., Кульчицкий О. К. Гипертоническая болезнь и орган зрения: патогенез, диагностика, лечение. — Минск: Беларусь, 2019. — 198 с.
11. Жумаева, Г. А., Рахматова, М. Р., Жалолова, В. З., & Юлдашева, Н. М. (2020). Значение эндотелия сосудов в регуляции местного кровотока. Биология и интегративная медицина, (4 (44)), 44-57.
12. Жумаева Г. А. и др. Достигнутые успехи в изучении патогенеза и диагностики гипертонической болезни //Новый день в медицине. — 2020. — №. 1-С. — С. 30-34.
13. Жумаева Г. А. и др. Клинико-фармакологические подходы лечения гипертонической болезни //Новый день в медицине. — 2020. — №. 1. — С. 26-29.
14. Джумаева, Г. А., Рахматова, М. Р., Жалолова, В. З., & Юлдашева, Н. М. (2020). Аспекты выбора препаратов при лечении артериальной гипертензии. Биология и интегративная медицина, (4 (44)), 57-71.
15. Джумаева Г. А. и др. Аспекты выбора препаратов при лечении артериальной гипертензии //Биология и интегративная медицина. — 2020. — №. 4 (44). — С. 57-71.
16. Джумаева Г. А. и др. Сравнительная оценка влияние бисопролола и физиотенза на эндотелий зависимую тромбоцитопатию у больных гипертонической болезнью //Биология и интегративная медицина. — 2020. — №. 1 (41). — С. 15-31.
17. Орзиев З. М. и др. Развитие железодефицитной анемии в зависимости от региона //Хабаршысы вестник том. — 2018. — №. 7. — С. 74-76.
18. Кароматов И. Д., Рахматова М. Р., Жалолова В. З. Лекарственные растения и медикаменты. — 2020.