# Acute Effects of Caffeine on the Microcirculation: Looking to the Systemic Circulation through the Retina as a Window

**Mehrdad Motamed Shariati***

*Eye Research Center, Khatam Al-Anbia Eye Hospital, Gharani Boulevard, Mashhad, Iran*

***Corresponding Author****

Mehrdad Motamed Shariati
Eye Research Center
Khatam Al-Anbia Eye Hospital
Gharani Boulevard, Mashhad, Iran
E-mail: mehrdad_shariati2005@yahoo.com

**Copyright:** © 2022 Shariati MM. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

**Received:** 18-Jul-2022, Manuscript No. JBTW-22-69398; **Editor assigned:** 21-Jul-2021, PreQC No. JBTW-22-69398(PQ); **Reviewed:** 04-Aug-2022, QC No. JBTW-22-69398; **Revised:** 11-Aug-2022, Manuscript No. JBTW-22-69398 (R); **Published:** 18-Aug-2022, DOI:10.35248/2322-3308-11.5.001.

## Description

The aim of this study is to find about the effects of caffeine on the circulatory system, specifically retinal blood flow. Evaluation of the retinal microvasculature using Optical Coherence Tomography Angiography (OCTA) is a helpful method to investigate the local and systemic effects of caffeine consumption on blood microcirculation and health.

As previous studies have shown, the retina is a good candidate for research in neuro-circulation [1,2]. Embryologically, neuroretina has the same origin as the brain, making it reasonable to consider the retina as a protrusion of the brain. Furthermore, the vascular supply of the retina originates from the ophthalmic artery, which is a branch of the internal carotid artery. Besides, neurotransmitters found in the retina are the same as in the brain [3].

The eye has transparent media and easily could be evaluated with different kinds of imaging modalities. Optical Coherence Tomography Angiography (OCTA) is a non-invasive, inexpensive, available, and precise technique for the assessment of retinal blood flow [4-15].

Here, we are going to review the literature about the effects of caffeine on the circulatory system, specifically retinal blood flow.

### Search strategy

A PubMed (http://www.ncbi.nlm.nih.gov/pubmed) search among English literature up to July 17, 2022 was conducted by using the key terms "caffein"(All Fields) or "caffeinated"(All Fields) or "caffeine"(MeSH Terms) or "caffeine" (All Fields) OR "caffeine s" ( All Fields) or "caffeines" ( All Fields) or "caffeinism"(All Fields) and ("retinaldehyde"( MeSH Terms) or "retinaldehyde"(All Fields) or "retinal"(All Fields) or "retina"(MeSH Terms) or "retina"(All Fields) or "retinally"(All Fields) or "retinals"(All Fields) or "retinitis"(MeSH Terms) or "retinitis"(All Fields) and "macular"(All Fields) and ("blood circulation"(MeSH Terms) or "blood" (All Fields) and "circulation"(All Fields) or "blood circulation"(All Fields) or ("blood"(All Fields) and "flow"(All Fields) or "blood flow"(All Fields). The references of the reports included in the systematic search were also reviewed to improve the probability of finding more relevant articles. In this mini-review, only articles about the acute effects of caffeine on the microcirculation of macula and/or optic nerve head were assessed. The articles that evaluated the neurostructural effects of caffeine or the systemic circulatory effects of caffeine were excluded.

Acute effects of caffeine on the macular and/or peripapillary circulation have been evaluated in previous studies (Table 1). Most of the studies showed a significant decrease in the macular or peripapillary blood flow, shortly after caffeine consumption. Despite an acute reduction in blood flow, long-term effects of caffeine have not been investigated and the effect of caffeine on retinal circulation health cannot be judged.

It seems that the main mechanism is acute vasoconstriction, which occurs following caffeine consumption. After consuming caffeine, the adenosine A2A receptors of the smooth muscles of the blood vessels are inhibited, and due to the fact that adenosine is a natural vasodilator, the stiffness of the vessel wall increases. These events are responsible for the transient increase in blood pressure following caffeine consumption [5]. The results of the studies on the long-term effects of caffeine on hemodynamics are controversial [6].

**Table 1.** Summary of previous studies about the acute effects of caffeine consumption on retinal microcirculation.

| Authors | Year | Aim of the study | Main findings |
|---|---|---|---|
| Omer K, et al. [11] | 2019 | To determine the acute effects of caffeine consumption on the macular flow indices using OCTA | A significant decrease in macular superficial and deep flow indices has been reported. |
| Victoria L, et al. [12] | 2022 | To evaluate the macular flow indices changes following caffeine intake. | A significant reduction in macular vessel density. |
| Tugan Y, et al. [13] | 2022 | Macular and peripapillary flow changes following caffeine intake. | A significant decrease in macular and peripapillary vessel density was observed. |
| Naim T, et al. [14] | 2012 | Retinal blood vessel diameter changes after caffeine consumption. | A significant retinal blood vessel vasoconstriction has been shown 1 hour after caffeine intake. |
| Takashi T, et al.[15] | 2002 | To investigate the effects of caffeine consumption on the retinal microcirculation | Caffeine may increase vessel resistance and decrease blood flow at the macula. |

Regarding the transparent media of the eye and the ease of assessing retinal blood flow using OCTA, today many studies evaluated the effects of systemic disturbances of circulation including hypertension, hypotension, heart failure, and following dialysis on the retinal microcirculation [7,8]. In the same way, factors affecting cerebral blood flow can lead to changes in retinal blood flow [9]. It can be concluded that the study of retinal microcirculation changes can reflect brain microcirculation variations. While caffeine can directly affect retinal blood vessels, its systemic effects on hemodynamics may also affect retinal blood flow [10-15].

Evaluation of the retinal microvasculature using OCTA is a helpful method to investigate the local and systemic effects of caffeine consumption on blood microcirculation and health.

## References

1. Lee, WH, et al. "Retinal microvascular change in hypertension as measured by optical coherence tomography angiography." *Sci Rep* 9.1(2019):1-7.
2. Anjos, R, et al. "Application of optical coherence tomography angiography macular analysis for systemic hypertension. A systematic review and meta-analysis." *Am J Hypertens* 35.4(2022):356-364.
3. Ng, PC and Oliver, JJ. "Anatomy of the eye, in handbook of emergency ophthalmology." *J Ophtom* (2018):1-12.
4. Lains, I, et al. "Retinal applications of swept source Optical Coherence Tomography (OCT) and Optical Coherence Tomography Angiography (OCTA)." *Prog Retin Eye Res* 84(2021):100951.
5. Guessous, I, et al. "Blood pressure in relation to coffee and caffeine consumption." *Curr Hypertens Rep* 16.9(2014):1-9.
6. Mesas, AE, et al. "The effect of coffee on blood pressure and cardiovascular disease in hypertensive individuals: A systematic review and meta-analysis." *Am J Clin Nutr* 94.4(2011):1113-1126.
7. Nägele, MP, et al. "Retinal microvascular dysfunction in heart failure." *Eur Heart J* 39.1(2018):47-56.

8. Zhang, Y, et al. "Changes in retina and choroid after haemodialysis assessed using optical coherence tomography angiography." *Clin Exp Optom* 101.5(2018):674-679.

9. Caliskan, SG, et al. "Acute effects of energy drink on hemodynamic and electrophysiologic parameters in habitual and non-habitual caffeine consumers." *Clin Nutr ESPEN* 42(2021):333-338.

10. Peng, SL, et al. "Cerebral hemodynamic response to caffeine: Effect of dietary caffeine consumption." *NMR in Biomed* (2022):e4727.

11. Karti, O, et al. "Acute effect of caffeine on macular microcirculation in healthy subjects: An Optical Coherence Tomography Angiography (OCTA) Study." *Retina* 39.5(2019):964-971.

12. Law, VK and Lam, AK. "Effect of caffeine on superficial retinal vasculature of the macula in high myopes using optical coherence tomography angiography-A pilot study." *J Optom* 15.3(2022):210-218.

13. Yilmaz Tugan, B, et al. "Evaluation of macular and peripapillary vascular parameter change in healthy subjects after caffeine intake using optical coherence tomography angiography." *Indian J Ophthalmol* 70.3(2022):879-889.

14. Terai, N, et al. "The effect of caffeine on retinal vessel diameter in young healthy subjects." *Acta Ophthalmol* 90.7(2012):e524-8.

15. Okuno, T, et al. "Effects of caffeine on microcirculation of the human ocular fundus." *Japanese J Ophthalmol* 46.2(2002):170-176.

**Cite this article:** Shariati MM. Acute Effects of Caffeine on the Microcirculation: Looking to the Systemic Circulation through the Retina as a Window. J Biol Today's World, 2022, 11(5), 001-002