British Journal of Ophthalmology

Arterial Hypertension and Retinal Layer Thickness: the Beijing Eye Study

Journal:	*British Journal of Ophthalmology*
Manuscript ID	bjo-2022-322229.R1
Article Type:	Clinical science
Date Submitted by the Author:	27-Sep-2022
Complete List of Authors:	Xie, Hui; University of Iowa, Department of Electrical and Computer Engineering Pan, Zhe; Beijing Ophthalmology and Visual Sciences Key Laboratory; Peking University Third Hospital, Department of Ophthalmology Xue, Cancan; Peking University Third Hospital, Ophthalmology Chen, Danny; University of Notre Dame, Department of Computer Science and Engineering Jonas, Jost; Heidelberg University, Ruprecht-Karls-University Heidelberg, Seegartenklinik Heidelberg Wu, Xiaodong; Iowa State University Department of Electrical and Computer Engineering Wang, Ya Xing; Beijing Institute of Ophthalmology, Department of Electrical and Computer Engineering
Keywords:	Anatomy, Epidemiology, Retina

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

Arterial Hypertension and Retinal Layer Thickness: the Beijing Eye Study

Hui Xie[1], Zhe Pan (MD)[2,3], CanCan Xue[2,3], Danny Chen[4], Jost B Jonas (MD)[2,5,6,7], Xiaodong Wu*[1,8], Ya Xing Wang (MD)*[2]

(1) Department of Electrical and Computer Engineering, University of Iowa, Iowa City, USA
(2) Beijing Institute of Ophthalmology, Beijing Tongren Hospital, Capital Medical University, Beijing Ophthalmology and Visual Sciences Key Laboratory, Beijing, China
(3) Department of Ophthalmology, Peking University Third Hospital, Beijing, China
(4) Department of Computer Science and Engineering, University of Notre Dame, Indiana, USA
(5) Department of Ophthalmology, Medical Faculty Mannheim Heidelberg University, Mannheim, Germany
(6) Institute of Clinical and Scientific Ophthalmology and Acupuncture Jonas & Panda, Heidelberg, Germany
(7) Institute of Molecular and Clinical Ophthalmology, Basel, Switzerland
(8) Department of Radiation Oncology, University of Iowa, Iowa City, USA

Short title: Arterial Hypertension and Retinal Layer Thickness
Key words: Retinal nerve fiber layer; Retinal inner nuclear layer; Arterial hypertension; Blood pressure; Beijing Eye Study
***Correspondence to:** Dr. Ya Xing Wang, Beijing Institute of Ophthalmology, Beijing Tongren Eye Center, Beijing Tongren Hospital, Capital University of Medical Science, 1 Dongjiaomin Lane, Dongcheng District, Beijing 100730, China (Tel: 86-10-58265917. Fax: 86-10-58269930. Email: yaxingw@gmail.com; and Dr. Xiaodong Wu, Department of Electrical and Computer Engineering, University of Iowa, 3318 Seamans Center for the Engineering Arts and Sciences, Iowa City, IA 52242. Email: xiaodong-wu@uiowa.edu.

Synopsis

Thickness of the retinal nerve fiber layer, ganglion cell layer and photoreceptor outer segment layer in normal eyes was inversely, and thickness of the inner nuclear layer was positively, associated with higher blood pressure.

Abstract

Purpose: To investigate relationships between blood pressure and the thickness of single retinal layers in the macula.

Methods: Participants of the population-based Beijing Eye Study, free of retinal or optic nerve disease, underwent a medical and ophthalmological examinations including optical coherence tomographic examination of the macula. Applying a multiple-surface segmentation solution, the retina was automatically segmented into its various layers.

Results: The study included 2237 participants (mean age:61.8±8.4 years;range 50–93 years). Mean thickness of the retinal nerve fiber layer (RNFL), ganglion cell layer (GCL), inner plexiform layer, inner nuclear layer (INL), outer plexiform layer, outer nuclear layer/external limiting membrane, ellipsoid zone, photoreceptor outer segments (POS), and retinal pigment epithelium-Bruch membrane was 31.1±2.3 µm, 39.7±3.5 µm, 38.4±3.3 µm, 34.8±2.0 µm, 28.1±3.0 µm, 79.2±7.3 µm, 22.9±0.6 µm, 19.2±3.3 µm, and 20.7±1.4µm, respectively. In multivariable analysis, higher systolic blood pressure (SBP) and diastolic blood pressure (DBP) were associated with thinner GCL and thicker INL, after adjusting for age, sex, and axial length (all P<0.0056). Higher SBP was additionally associated with thinner POS, and higher DBP with thinner RNFL. For an elevation of SBP/DBP by 10 mmHg, the RNFL, GCL, INL, and POS changed by 2µm, 3µm, 1.5µm, and 2µm, respectively.

Conclusions: Thickness of RNFL, GCL and POS was inversely, and INL thickness was positively, associated with higher blood pressure, while the thickness of the other retinal layers was not significantly correlated with blood pressure. The findings may be helpful for refinement of the morphometric detection of retinal diseases.

Key Messages

- What is already known on this topic: Associations between higher blood pressure and a thinning of the peripapillary retinal nerve fiber layer and macular retinal ganglion cell layer have been reported by previous studies, while a detailed analysis of the associations of the thickness of the various retinal layers with blood pressure has been missing so far.
- What this study adds: With the strengths of a large sample size, a population-based enrollment, comprehensive adjustment for multiple potential confounders, medical examination-based exclusion of individuals with retinal or optic nerve diseases, application of a newly developed segmentation tool based on deep learning and an interior point method, and measurement of all retinal layers in the macula region, the study revealed that the thickness of the retinal nerve fiber layer, ganglion cell layer and photoreceptor outer segments layer was inversely, and the thickness of the inner nuclear layer was positively, associated with higher blood pressure, while the thickness of the other retinal layers was not significantly correlated with blood pressure.

- How this study might affect research, practice or policy: The findings may be helpful for refinement of the optical coherence tomography-based morphometric detection of retinal diseases, elaboration of the etiology of the effect of arterial hypertension on the various retinal layers taken separately, and for the comparison of the effect of arterial hypertension on other regions of the central nervous system.

Introduction

Arterial hypertension is a primary risk factor for cardiovascular disease and mortality, accounting for 19.2% of all deaths worldwide.[1]. High arterial blood pressure increases peripheral vascular resistance and causes microvascular changes in many organ systems including the brain, heart, kidneys, and eyes, with the eye being the only organ where microvascular changes can directly and noninvasively be visualized.[2,3] Hypertension alters the ocular circulation including a reduction in the retinal vessel density and subsequently causes a series of ophthalmological disorders such as hypertensive retinopathy, choroidopathy, optic neuropathy, and retinal vessel occlusions.[2] Ophthalmoscopical signs of hypertensive changes of the retina include flame-shaped or blot-shaped intraretinal hemorrhages, cotton-wool spots as micro-infarcts of the retinal nerve fiber layer, hard exudates, and microaneurysms.[4-6]

Optical coherence tomographic (OCT) examinations of the retina revealed that hypertensive patients without clinically detected hypertensive retinopathy as compared to healthy individuals had a significantly thinner central macula, a reduced peripapillary retinal nerve fiber layer (RNFL), and a thinner ganglion cell-inner plexiform layer (GC-IPL).[7-11] These previous studies examining the effect of blood pressure and arterial hypertension on retinal thickness were focused primarily on the thickness of the whole retina or on the thickness of the GC-IPL and peripapillary RNFL only, while other retinal layers have not been comprehensively investigated in their associations with blood pressure yet. The previous studies were additionally limited by a hospital-based recruitment of the study participants, relatively small study sample sizes, and a relatively small number of additional parameters examined. We therefore evaluated the relationship between the thickness of the single retinal layers with blood pressure/hypertension in the population-based Beijing Eye Study. In association with deep learning, we applied a newly developed system for multiple optimal surface segmentation in retinal OCT images with sub-pixel accuracy for the delineation of the single retinal layers.[12] To avoid a bias by concurrent ocular diseases, we included only those participants who were free of retinal or optic nerve diseases. We additionally assessed a potential association between anti-hypertensive medication and retinal layer thickness.[13]

The results may be useful to get more information on the influence of hypertension on the single retinal layers as part of the central nervous system, they may be helpful to define the normative values of the thickness of the single retinal layers in dependence of blood pressure / hypertension, and they may be useful to improve the detection and management of retinal and optic nerve eye diseases.

Methods

The Beijing Eye Study 2011 is a population-based cross-sectional study, carried out in urban and rural districts of Greater Beijing. Eligibility criteria were an age of 50+ years and living in the study regions.[14,15] All study participants underwent a series of examinations, including an interview with questions about their level of education, family status, history of diseases, smoking and alcohol consumption, physical

activity, and cognitive function. Biochemical tests assessed the serum concentration of lipids, glucose, glycosylated hemoglobin A1c, high-sensitive C-reactive protein, and creatinine. Body height, weight, and the circumferences of neck, waist, and hip were measured. The blood pressure was determined using an automatic blood pressure monitor (HM-1000, Omron, Kyoto, Japan), after the participants had rested for at least 5 minutes under standardized conditions. We defined and staged arterial hypertension according to the criteria published by the American Heart Association.[16] Hypertension was defined by a systolic blood pressure (SBP) of ≥130 mmHg and/or a diastolic blood pressure (DBP) of ≥80 mmHg (and/or a history of hypertension or antihypertensive medication).[16] The blood pressure was categorized as normal, elevated, stage 1 hypertension, and stage 2 hypertension.

Detailed ophthalmological examinations included refractometry and measurement of best corrected visual acuity, slit lamp-based biomicroscopic examination of the anterior segment lens, and fundus photography of the macula and optic disc (CR6-45NM Camera, Canon Inc., Ota, Tokyo, Japan). Using optical low-coherence reflectometry (Lenstar 900® Optical Biometer, Haag-Streit, 3098 Koeniz, Switzerland), biometry of the right eyes was performed for measurement of axial length. Intraocular pressure was determined using a non-contact tonometer (CT-60 computerized tonometer, Topcon Ltd., Tokyo, Japan). Using spectral-domain OCT (Spectralis OCT; Heidelberg Engineering, Heidelberg, Germany), the macular area was scanned by a cube scan mode, compromising 31 continuous horizontal B scans. The whole scanning area encompassed 30° x 25°and was centered on the fovea. The image penetration resolution was 3.87 µm/pixel (z-resolution). Each scan line included 100 averaged scans.

For segmentation of the various retinal layers, we used a multiple-surface OCT segmentation algorithm, which had been developed based on a deep learning approach and an interior point method.[12,17] Recent analyses of the algorithm had shown a test error of less than one-pixel size.[12] Assessing the retinal surface and 9 intraretinal interfaces, the thickness of nine retinal layers were computed as the distance between two adjacent surfaces or interfaces, perpendicular to the retinal pigment epithelium-Bruch´s membrane (RPE/BM)'s surface (Fig. 1). The nine layers included the RNFL, ganglion cell layer (GCL), inner plexiform layer (IPL), inner nuclear layer (INL), outer plexiform layer (OPL), outer nuclear layer including the external limiting membrane (ONL/ELM), ellipsoid zone (EZ), photoreceptor outer segments (POS), and the RPE/BM.[18] The mean thickness of each layer was calculated in nine regions defined by the grid of the Early Treatment of Diabetic Retinopathy Study (ETDRS).[19]

From the 3234 participants of the Beijing Eye Study with OCT macular scans, we excluded those with glaucoma, non-glaucomatous optic neuropathy, any macular diseases, retinal diseases including retinal vein occlusion and diabetic retinopathy, and high myopia defined by an axial length of ≥26 mm or a refractive error of ≤-6 diopter. In a next step, we excluded those individuals with intraocular pressure readings of >21 mmHg, a best corrected visual acuity of >0.20 logMAR (negative logarithm of the minimal angle of resolution) (decimal <0.6), and those individuals with an OCT image quality score of <20. In a last step, we excluded those participants with image segmentation errors, detected during an interactive

check by an experienced ophthalmologist (ZP). The data obtained on the right eyes were taken for statistical analysis.

The statistical analysis was performed using statsmodels package in Python 3 (Python Software Foundation Wilmington, DE, USA; https://www.python.org/). In the first step of the analysis, the retinal layer thickness in each ETDRS grid region was assessed. In a univariable linear regression analysis, we examined associations between the retinal layer thickness and other ocular and systemic parameters. Applying Bonferroni´s method of adjusting for performing multiple statistical analyses, and considering that the analysis was conducted for the nine ETDRS regions of each retinal layer, we considered an association being statistically significant if the *P*-value was <0.0056 for each measurement in at least two adjacent ETDRS grid regions. In a third step, we conducted a multivariable regression analysis, in which the dependent variable was the retinal layer thickness in each ETDRS grid region, while the independent variables were those parameters which were significantly associated with the retinal thickness measurement in the univariable analysis.

Results

The study included 2237 eyes of 2237 participants (968 (43.3%) men) with a mean age of 61.8±8.4 years (range: 50-93 years) and a mean axial length of 23.1±0.8 mm (range:19.0-25.9 mm). The mean systolic and diastolic blood pressures were 132±21 mmHg and 73±13 mmHg, respectively, and hypertension was detected in 1171 (52.3%) participants. The mean thicknesses of the RNFL, GCL, IPL, INL, OPL, ONL/ELM, EZ, POS and RPE/BM were 31.1±2.3 µm, 39.7±3.5 µm, 38.4±3.3 µm, 34.8±2.0 µm, 28.1±3.0 µm, 79.2±7.3 µm, 22.9±0.6 µm, 19.2±3.3 µm, and 20.7±1.4 µm, respectively (Table 1).

In univariable linear regression analysis, the thickness of the single retinal layers measured as mean in all ETDRS regions was associated with various systemic and ocular parameters (Table 2). Similar results were obtained if the thickness of the retinal layers measured separately in the various ETDRS grid sectors was taken as dependent parameter (Supplementary Tables 1-3). Using a *P*-value of <0.0056 as the criterion of statistical significance for associations of the retinal layer thickness with other parameters in at least two adjacent ETDRS grid regions, the parameters of age, sex and axial length were related to the thickness of almost all retinal layers, except for the OPL thickness and the RPE/BM thickness, which were not significantly correlated with sex. The thickness of the INL, ONL/ELM and POS was additionally correlated with the intraocular pressure. The thickness of the INL and RPE/BM was associated with the body mass index (Supplementary Tables 1-3)

In a multivariable analysis, with the retinal layer thickness in the ETDRS field sector as dependent variable and all parameters with a significant association with the retinal layer thickness in the ETDRS field sector as independent variables, increasing SBP and DBP were associated with a thinning of the GCL and a thickening of the INL, with adjustments made for age, sex, and axial length. An increased SBP was additionally associated with a thinning of POS, while an increased DBP was additionally

associated with a thinning of RNFL (all $P<0.0056$ in ≥ 2 adjacent ETDRS grids) (Tab 3, 4) (Fig. 2). The total retinal thickness was not related with SBP or DBP, when calculated as a whole or in any subfield (Table 3, 4).

A heatmap illustrated the magnitude of the associations between SBP/DBP and the related retinal layer thickness, in which the association with GCL thickness was most pronounced (Fig. 2). The blood pressure-associated GCL thinning was located mainly in the nasal and inferior region of the ETDRS grid, with a 3 μm GCL thickness decrease for every 10 mm Hg increase in SBP or DBP. The blood pressure-associated INL thickening was notable most in the temporal region and in the parafoveal regions, with a 1.5 μm INL thickness increase for every 10 mm Hg increase in SBP or DBP. The POS thickness decreased by 2 μm for every 10 mm Hg elevation in SBP in the central fovea region, while The RNFL thickness decreased by 2.0-2.6 μm for every 10 mm Hg elevation in DBP in the superior and temporal region (Tab 3, 4) (Fig. 2).

When participants were categorized into normal blood pressure, elevated blood pressure, hypertension stage 1, and hypertension stage 2, the mean thickness of RNFL, GCL, INL and POS in the associated regions were calculated, after adjusting for parameters such as age, sex and axial length. With increasing blood pressure stage, the GCL and POS got thinner, while the INL got thicker ($P<0.01$). The association with a decreasing RNFL thickness was marginally significant ($P=0.051$).

As compared with the hypertensive patients without anti-hypertensive medication, the group with anti-hypertensive therapy (786 out of 1171, 67.1%) had a significant lower SBP or DBP (SBP: 135±20 versus 145±20mmHg; DBP: 71±13 mmHg versus 79±13 mmHg, both $P<0.001$). The thickness of the RNFL, GCL, INL, and POS did not differ significantly ($P>0.05$) between the treated group and the untreated group after adjusting for age, sex, and axial length.

Discussion

In our population-based study, higher blood pressure was associated in the macular region with a thinner RNFL, GCL, and POS, and with a thicker INL, after adjusting for factors such as age, sex, and axial length. The thickness of the other retinal layers in the macular region were not affected by blood pressure. Although associated with a lower blood pressure, use of anti-hypertensive medication was not related to the thickness of any retinal layer in the multivariable analysis.

The finding of a decreased GCL with increased blood pressure agrees with observations made in previous studies. Lim and colleagues found in their clinical study on 84 hypertensive patients and 117 healthy controls, that prolonged hypertension was associated with a thinner GC-IPL and decreased retinal blood flow.[8] Similar results were obtained in another hospital-based study by Lee and associates, who detected a thinner central macula, a thinner macular RNFL, and a thinner GC-IPL in individuals with chronic hypertension, in particular in those with a previous hypertensive retinopathy.[7] In a prospective, longitudinal study including 49 eyes with hypertension and 56 controls with a follow-up of 4 years,

hypertensive patients with well-controlled blood pressure showed a thinning of their GC-IPL as compared to normal subjects.[9] In a population-based multiethnic study on black, Chinese, and Latino Americans with healthy eyes, hypertension was associated with a thinner RNFL in a multivariable analysis.[20] In contrast, in the population-based Singapore Epidemiology of Eye Diseases Study and the Singapore Chinese Eye Study, the GC-IPL thickness was not correlated with blood pressure.[21-23] Discrepancies in the results obtained in the various studies might have been due to differences between the studies in the outlining of the retinal layers, study designs, composition of the study populations, blood pressure control, and types of anti-hypertensive drugs used.

Interestingly, the macular RNFL thickness in our study population was found to be correlated only with DBP, but not with SBP. The reason might be that the association between higher SBP and thinner RNFL did not reach the level of statistical significance as set after Bonferroni´s correction by a *P*-value of <0.0056 (Table 3). A marginally significant correlation between SBP and RNFL thickness at a significance level of $P<0.05$ was found in 4 out of 9 ETDRS sectors.

The finding that the higher blood pressure was more strongly associated with a thinning of the GCL than with a thinning of the macular RNFL suggests that the effects of hypertension in the macular region may more easily be detectable by examining the GCL than by assessment of the macular RNFL. A negative correlation between hypertension and thickness of the peripapillary RNFL has been widely reported, while associations with the thickness of the macular RNFL have been less frequently explored. In hospital-based studies, Pappelis et al. reported that treated hypertensive patients showed a thinner macular RNFL when compared with a control group.[24] Lee and colleagues also found a decrease in the macular RNFL thickness for 18 patients with hypertensive retinopathy who had been followed for more than one year.[25] In the Singapore Epidemiology of Eye Diseases Study, the RNFL thickness was not associated with the presence of hypertension.[23] Our study suggested that a thinning of the GCL as compared to thickness changes in other retinal layers was the most pronounced alteration found in association with arterial hypertension. It shows the importance of examining the macular GCL thickness.

A new observation made in our study was that higher blood pressure was associated with a thicker INL. The INL statistically increased in thickness by 1.5 µm for every 10 mm Hg increase in SBP or DBP. The reasons for this association have been unknown yet. Since the OCT images did not reveal any intraretinal edema, an internuclear blood pressure-related edema as cause for the association may be unlikely. A coincidental statistical significance may also be unlikely since Bonferroni´s method was applied to correct the results of the statistical analysis for performing multiple statistical comparisons. Future studies may therefore focus on the histological and molecular biological basis of the observation of a blood pressure-related increase in the INL thickness. Interestingly, the prevalence of arterial hypertension was not statistically significantly associated with the INL thickness. It concurs with the findings made in the Singapore Epidemiology of Eye Diseases Study in which a significant association between INL thickness and prevalence of hypertension was neither found.[23] In that study, an association between INL thickness and SBP or DBP was not assessed.

In our study population the thickness of the POS layer decreased with higher SBP. It agrees with the results of the UK Biobank study, in which higher SBP was related to a thinner INL-RPE layer and a thinner ELM-ISOS layer, as measured in 32,923 participants aged 40–69 years.[26] The authors discussed that higher SBP may lead to the thinning of the photoreceptor-related retinal layers either by intermittently reducing the blood flow in the deep capillary plexus, or by changing the choroidal permeability.

The finding that the thickness of the single retinal layers did not differ between patients with anti-hypertensive medication and untreated hypertensive patients despite a lower blood pressure in the treated group may be due to several reasons, including a potentially longer duration of elevated blood pressure in the treated group. As in our study population, use of anti-hypertensive medications, specifically angiotensin-converting enzyme inhibitors or diuretics, was associated with a thinner RNFL and a thinner GC -IPL in the population of the Singapore Epidemiology of Eye Diseases Study, independent of the mean blood pressure.[13]

Potential limitations of our study should be discussed. First, the exclusion of eyes with poor scan quality might have introduced a selection bias. Second, as only Chinese aged 50+ years were included into the study population, the findings of the study may not be directly applicable to other age or ethnic groups. Third, information on the types of anti-hypertensive medications was not taken into analysis. The strengths of our study include its large sample size, a population-based enrollment, and comprehensive adjustment for multiple potential confounders, including axial length and systemic biochemical parameters. In addition, individuals with retinal or optic nerve diseases were excluded according to a standardized methodology rather than by relying on self-reported or medical records, hence it was not likely that the association between retinal layer thickness and blood pressure was influenced by eye diseases. We used a newly developed segmentation tool based on deep learning and an interior point method, which has been shown to have a relatively small segmentation error. And, it is the first population-based study specifically examining associations between systemic blood pressure and the thickness of the single retinal layers in the macular region.

In conclusion, the thickness of the RNFL, GCL and POS in individuals free of retinal and optic nerve diseases was inversely correlated with higher blood pressure, while the thickness of the INL was positively related to blood pressure. Hypertensive patients with better controlled blood pressure by receiving anti-hypertensive medication did not show differences in the thickness of the single retinal layers as compared to individuals who did not receive treatment. The findings may be helpful for a refinement in the morphometric detection of retinal diseases and they may be useful for the comparison with microvascular hypertension-associated changes in other regions of the central nervous system.

Metadata

a) Funding: National Natural Science Foundation of China (#81570835); Beijing Municipal of Health Reform and Development Project (#2019-4); National Science Foundation of USA (CCF-1733742).

b) Financial Disclosures: None
c) Author contributions: Study design: HX, ZP, CCX, DC, JBJ, XW, YXW; Examination of participants: HX, ZP, CCX, DC, JBJ, XW, YXW; Statistical analysis: HX, ZP, CCX, DC, JBJ, XW, YXW; writing of first draft: HX, YXW, JBJ; revision and final approval: HX, ZP, CCX, DC, JBJ, XW, YXW.
d) Ethics Statement: The study was approved by the Medical Ethic Committee of Beijing Tongren Hospital. The Ethics Approval Letter was without reference number, at that time of application.
Ethics statement:
e) Other Acknowledgements: None.

References

1. GBD 2019 Risk Factors Collaborators. Global burden of 87 risk factors in 204 countries and territories, 1990-2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet. 2020;396(10258):1223-1249.

2. Wong TY, Mitchell P. The eye in hypertension. Lancet. 2007;369(9559):425-35.

3. Zhou B, Perel P, Mensah GA, Ezzati M. Global epidemiology, health burden and effective interventions for elevated blood pressure and hypertension. Nat Rev Cardiol. 2021;18(11):785-802.

4. Tso MO, Jampol LM. Pathophysiology of hypertensive retinopathy. *Ophthalmology* 1982;89(10):1132-1145.

5. Wong TY, Mitchell P. Hypertensive retinopathy. *N Engl J Med* 2004;351(22):2310-2317.

6. Konstantinidis L, Guex-Crosier Y. Hypertension and the eye. Curr Opin Ophthalmol. 2016;27(6):514-521.

7. Lee SH, Lee WH, Lim HB, Jo YJ, Kim JY. Thicknesses of central macular, retinal nerve fiber, and ganglion cell inner plexiform layers in patients with hypertension. Retina. 2019;39(9):1810-1818.

8. Lim HB, Lee MW, Park JH, Kim K, Jo YJ, Kim JY. Changes in ganglion cell-inner plexiform layer thickness and retinal microvasculature in hypertension: an optical coherence tomography angiography study. Am J Ophthalmol. 2019;199:167-176.

9. Lee WH, Lee MW, Lim HB, Kim KM, Shin YI, Kim JY. Longitudinal changes in the thickness of the ganglion cell-inner plexiform layer in patients with hypertension: a 4-year prospective observational study. Acta Ophthalmol. 2020;98(4):e479-e486.

10. Mauschitz MM, Bonnemaijer PWM, Diers K, Rauscher FG, Elze T, Engel C, Loeffler M, Colijn JM, Ikram MA, Vingerling JR, Williams KM, Hammond CJ, Creuzot-Garcher C, Bron AM, Silva R, Nunes S, Delcourt C, Cougnard-Grégoire A, Holz FG, Klaver CCW, Breteler MMB, Finger RP; European Eye Epidemiology (E3) Consortium. Systemic and ocular determinants of peripapillary retinal nerve fiber layer thickness measurements in the European Eye Epidemiology (E3) Population. Ophthalmology. 2018;125(10):1526-1536.

11. Cheung CY, Ikram MK, Chen C, Wong TY. Imaging retina to study dementia and stroke. Prog Retin Eye Res 2017;57:89-107.

12. Xie H, Pan Z, Zhou L, Zaman FA, Chen DZ, Jonas JB, Xu W, Wang YX, Wu X. Globally optimal OCT surface segmentation using a constrained IPM optimization. Optics Express. 2022;30(2):2453-2471.

13. Chong RS, Chee ML, Tham YC, Majithia S, Thakur S, Teo ZL, Da Soh Z, Chua J, Tan B, Wong DWK, Schmetterer L, Sabanayagam C, Cheng CY. Association of antihypertensive medication with retinal nerve fiber layer and ganglion cell-inner plexiform layer thickness. Ophthalmology. 2021;128(3):393-400.

14. Wang YX, Pan Z, Zhao L, You QS, Xu L, Jonas JB. Retinal nerve fiber layer thickness. The Beijing Eye Study 2011. Plos One. 2013;8(6)e66763.

15. Yan YN, Wang YX, Xu L, Xu J, Wei WB, Jonas JB. Fundus tessellation: prevalence and associated factors The Beijing Eye Study 2011. Ophthalmology. 2015;122(9):1873-1880.

16. Whelton PK, Carey RM, Aronow WS, Casey DE Jr, Collins KJ, Dennison Himmelfarb C et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: executive summary: a report of the American College of Cardiology/American Heart Association task force on clinical practice guidelines. Hypertension 2018;71(6):1269-1324

17. Shah A, Zhou L, Abrámoff MD, Wu X. Multiple surface segmentation using convolution neural nets: application to retinal layer segmentation in OCT images. *Biomed Opt Express* 2018;9(9):4509-4526.

18. Cuenca N, Ortuño-Lizarán I, Pinilla I. Cellular characterization of OCT and outer retinal bands using specific immunohistochemistry markers and clinical implications. *Ophthalmology* 2018;125(3):407-422.

19. Writing Committee for the Diabetic Retinopathy Clinical Research Network, Fong DS, Strauber SF, Aiello LP, Beck RW, Callanan DG, et al. Comparison of the modified Early Treatment Diabetic Retinopathy Study and mild macular grid laser photocoagulation strategies for diabetic macular edema. *Arch Ophthalmol* 2007;125(4):469-480.

20. Nousome D, McKean-Cowdin R, Richter GM, Burkemper B, Torres M, Varma R, Jiang X. Retinal nerve fiber layer thickness in healthy eyes of Black, Chinese, and Latino Americans: a population-based multiethnic study. Ophthalmology. 2021;128(7):1005-1015.

21. Tham YC, Chee ML, Dai W, Lim ZW, Majithia S, Siantar R, Thakur S, Rim T, Cheung CY, Sabanayagam C, Aung T, Wong TY, Cheng CY. Profiles of ganglion cell-inner plexiform layer thickness in a multi-ethnic Asian population: the Singapore Epidemiology of Eye Diseases Study. Ophthalmology. 2020;127(8):1064-1076.

22. Koh VT, Tham YC, Cheung CY, Wong WL, Baskaran M, Saw SM, Wong TY, Aung T. Determinants of ganglion cell-inner plexiform layer thickness measured by high-definition optical coherence tomography. Invest Ophthalmol Vis Sci. 2012;53(9):5853-5859.

23. Chua J, Tham YC, Tan B, Devarajan K, Schwarzhans F, Gan A, Wong D, Cheung CY, Majithia S, Thakur S, Fischer G, Vass C, Cheng CY, Schmetterer L. Age-related changes of individual macular retinal layers among Asians. Sci Rep. 2019;9(1):20352.

24. Pappelis K, Jansonius NM. U-shaped effect of blood pressure on structural OCT metrics and retinal perfusion in ophthalmologically healthy subjects. Invest Ophthalmol Vis Sci. 2021;62(12):5.

25. Lee HM, Lee WH, Kim KN, Jo YJ, Kim JY. Changes in thickness of central macula and retinal nerve fibre layer in severe hypertensive retinopathy: a 1-year longitudinal study. Acta Ophthalmol. 2018;96(3):e386-e392.

26. Chua SYL, Dhillon B, Aslam T, Balaskas K, Yang Q, Keane PA, Tufail A, Reisman C, Foster PJ, Patel PJ; UK Biobank Eye and Vision Consortium. Associations with photoreceptor thickness measures in the UK Biobank. *Sci Rep* 2019;9(1):19440.

Table 1. Thickness of the segmented layers of retina in 9 Early Treatment Diabetic Retinopathy Study (ETDRS) subfields.

	F	IN	IS	IT	II	ON	OS	OT	OI
RNFL	16.8±2.5	28.9±2.7	35.1±3.3	24.6±2.0	34.4±3.2	39.5±3.8	40.8±4.3	20.9±1.8	39.2±4.3
GCL	28.4±5.2	49.0±5.8	46.0±4.8	43.7±4.9	46.4±4.9	44.9±4.7	33.0±3.4	31.1±3.3	34.3±3.7
IPL	31.1±4.3	38.3±4.5	41.7±4.4	42.5±4.4	41.6±4.4	38.7±3.6	33.6±3.4	43.1±3.9	35.0±3.4
INL	28.3±2.8	38.8±2.4	38.4±2.4	36.9±2.4	38.0±2.3	36.7±2.4	31.6±2.4	33.0±2.2	32.1±2.2
OPL	26.1±3.7	33.5±8.6	29.9±5.5	27.1±2.3	28.3±4.2	31.5±5.7	26.2±3.2	25.2±2.1	25.0±2.7
ONL/ELM	98.9±8.7	84.3±12.5	78.1±9.0	85.3±7.0	83.1±8.2	70.8±9.6	65.2±7.0	73.3±6.2	73.5±6.9
EZ	24.1±0.5	23.0±0.7	22.9±0.7	23.1±0.7	22.8±0.7	22.1±0.7	23.3±1.3	22.5±1.0	22.5±0.9
POS	24.3±3.5	20.9±3.4	19.1±3.6	20.5±3.3	20.6±3.4	17.3±3.7	14.9±4.1	17.3±3.6	18.1±3.8
RPE/BM	19.6±1.7	20.1±1.9	20.5±1.7	19.9±1.8	20.3±1.7	21.1±1.6	22.0±1.3	21.3±1.5	21.3±1.5

Data are shown as mean ± standard deviation (μm)

The ETDRS subfields include fovea (F), inner nasal (IN), inner superior (IS), inner temporal (IT), inner inferior (II), outer nasal (ON), outer superior (OS), outer temporal (OT), and outer inferior (OI) subfields.

RNFL: retinal nerve fiber layer; GC-IPL: ganglion cell-inner plexiform layer; SBP: systolic blood pressure; DBP: diastolic blood pressure; RPE/BM: retinal pigment epithelium-Bruch's membrane; GCL: ganglion cell layer; IPL: inner plexiform layer; INL: inner nuclear layer; OPL: outer plexiform layer; ONL/ELM: outer nuclear layer/external limiting membrane; EZ: ellipsoid zone; POS: photoreceptor outer segments.

Table 2. Association (univariate linear regression) between the average thickness of each layer and major systemic and ocular parameters

	RNFL	GCL	IPL	INL	OPL	ONL/ELM	EZ	POS	RPE/BM
Age	1.40E-8 (-0.12**)	3.07E-31 (-0.24**)	4.33E-62 (-0.34**)	1.29E-124 (-0.47**)	6.15E-16 (0.17**)	4.42E-51 (-0.31**)	4.16E-16 (0.17**)	1.65E-103 (-0.43**)	1.78E-109 (0.45**)
Gender	0.134 (-0.03)	0.01 (0.05*)	0.009 (-0.06**)	0.002 (-0.07**)	0.347 (0.02)	2.79E-14 (-0.16**)	3.00E-6 (0.10**)	9.00E-6 (-0.09**)	0.309 (0.02)
Axial Length	1.05E-22 (0.21**)	0.651 (0.01)	0.002 (-0.07**)	4.72E-8 (-0.12**)	6.15E-13 (0.16**)	5.78E-13 (-0.16**)	5.15E-8 (0.12**)	2.68E-7 (-0.11**)	2.08E-12 (0.15**)
IOP	0.499 (0.01)	0.077 (0.04)	0.012 (0.05*)	1.02E-4 (0.08**)	0.359 (-0.02)	0.002 (0.07**)	0.127 (-0.03)	0.001 (0.07**)	0.017 (-0.05*)
Height	5.85E-8 (0.11**)	0.291 (0.02)	5.00E-6 (0.10**)	1.37E-8 (0.12**)	0.256 (-0.02)	4.39E-10 (0.13**)	3.00E-6 (-0.10**)	1.60E-11 (0.14**)	2.27E-4 (-0.08**)
Weight	0.273 (0.02)	0.225 (-0.03)	8.00E-6 (0.09**)	1.45E-9 (0.13**)	0.129 (-0.03)	1.60E-5 (0.09**)	0.001 (-0.07**)	8.00E-6 (0.10**)	2.37E-8 (-0.12**)
BMI	0.020 (-0.05*)	0.047 (-0.04*)	0.035 (0.05*)	0.001 (0.07**)	0.235 (-0.03)	0.368 (0.02)	0.325 (-0.02)	0.493 (0.02)	4.90E-5 (-0.09**)
Waist circumference	0.002 (-0.07**)	4.70E-5 (-0.09**)	0.417 (0.02)	0.122 (0.03)	0.114 (-0.03)	0.345 (0.02)	0.501 (-0.01)	0.492 (-0.02)	0.005 (-0.06**)
Hip circumference	0.039 (-0.04*)	0.187 (-0.03)	0.165 (0.03)	0.002 (0.06**)	0.057 (-0.04)	0.384 (0.02)	0.611 (-0.01)	0.261 (0.02)	4.00E-6 (-0.10**)
SBP	1.56E-4 (-0.08**)	8.70E-7 (-0.10**)	0.91 (-0.002)	0.900 (0.003)	0.411 (0.02)	0.393 (-0.02)	0.024 (0.05*)	5.20E-5 (-0.09**)	0.142 (0.03)
DBP	0.053 (-0.04)	0.66 (-0.01)	1.72E-4 (0.08**)	1.76E-12 (0.15**)	0.003 (-0.06**)	7.61E-8 (0.11**)	0.242 (-0.03)	3.24E-7 (0.11**)	6.42E-11 (-0.14**)
Hypertension	5.60E-5 (-0.09**)	5.60E-5 (-0.12**)	0.069 (-0.04)	1.95E-4 (-0.08**)	0.018 (0.05*)	0.005 (-0.06**)	0.432 (0.02)	8.00E-6 (-0.09**)	0.001 (0.07**)
Glucose	0.515 (0.02)	0.376 (-0.02)	0.525 (0.02)	0.452 (0.02)	0.265 (0.03)	0.010 (-0.06**)	0.005 (-0.07**)	0.012 (-0.06*)	0.004 (0.07**)
Diabetes	0.57 (-0.01)	0.048 (-0.04*)	0.697 (-0.01)	0.207 (-0.03)	0.132 (0.03)	0.044 (-0.04*)	0.029 (-0.05*)	8.90E-5 (-0.08**)	9.00E-6 (0.09**)
Cholesterol	0.874 (-0.004)	0.244 (0.03)	0.780 (-0.01)	0.981 (0.001)	0.577 (-0.01)	0.018 (-0.06*)	0.254 (-0.03)	0.238 (0.03)	0.985 (0)
HDL	0.824 (0.01)	0.134 (0.04)	0.523 (0.02)	0.048 (0.05*)	0.749 (0.01)	0.811 (0.01)	0.759 (0.01)	0.066 (0.05)	0.665 (-0.01)
LDL	0.557 (0.01)	0.104 (0.04)	0.659 (0.01)	0.49 (0.02)	0.232 (-0.03)	0.193 (-0.03)	0.367 (-0.02)	0.108 (0.04)	0.515 (-0.02)

TG	0.067 (-0.04)	0.197 (-0.03)	0.229 (-0.03)	0.055 (-0.05)	0.489 (-0.02)	0.045 (-0.05*)	0.213 (-0.03)	0.194 (-0.03)	0.758 (-0.01)

Data are presented as P-value (Correlation coefficient)

*Significance at the 0.05 level (2-tailed); **significance at the 0.01 level (2-tailed).

RNFL: retinal nerve fiber layer; GC-IPL: ganglion cell-inner plexiform layer; SBP: systolic blood pressure; DBP: diastolic blood pressure; RPE/BM: retinal pigment epithelium-Bruch's membrane; GCL: ganglion cell layer; IPL: inner plexiform layer; INL: inner nuclear layer; OPL: outer plexiform layer; ONL/ELM: outer nuclear layer/external limiting membrane; EZ: ellipsoid zone; POS: photoreceptor outer segments.

IOP: intraocular pressure; BMI: body mass index; SBP: systolic blood pressure; DBP: diastolic blood pressure; HDL: high density lipoprotein; LDL: low density lipoprotein; TG: triglyceride

Table 3. Associations (multivariate analysis) between systolic blood pressure and the thickness of 9 retinal layers in each Early Treatment Diabetic Retinopathy Study (ETDRS) grid sector, with adjustments for age, sex and axial length.

	RNFL	GCL	IPL	INL	OPL	ONL/ELM	EZ	POS	RPE/BM	Total Retina
F	0.835 (-0.01)	0.094 (-0.18)	0.953 (0.01)	0.116 (0.09)	0.736 (-0.03)	0.084 (0.30)	0.028 (0.03)	1.35E-03 (-0.22)	0.589 (-0.02)	0.927 (-0.03)
IN	0.864 (-0.01)	7.55E-03 (-0.33)	5.53E-03 (0.26)	1.12E-03 (0.16)	0.474 (-0.13)	0.301 (0.25)	0.090 (0.03)	5.85E-03 (-0.19)	0.839 (-0.01)	0.908 (0.04)
IS	0.027 (-0.15)	0.030 (-0.22)	0.149 (0.13)	0.031 (0.1)	0.533 (0.07)	0.825 (0.04)	6.53E-03 (0.04)	0.027 (-0.16)	0.763 (-0.01)	0.627 (-0.15)
IT	0.366 (0.04)	0.469 (-0.08)	0.872 (0.01)	5.68E-05 (0.18)	0.020 (0.11)	0.866 (-0.02)	0.215 (0.02)	0.012 (-0.16)	0.536 (-0.02)	0.785 (0.08)
II	0.255 (-0.08)	5.00E-04 (-0.36)	0.087 (0.15)	2.16E-03 (0.13)	0.811 (-0.02)	0.606 (-0.08)	0.045 (0.03)	4.61E-03 (-0.19)	0.460 (-0.02)	0.167 (-0.44)
ON	7.91E-03 (-0.21)	1.11E-03 (-0.31)	0.038 (0.15)	0.136 (0.07)	0.673 (0.05)	0.414 (-0.15)	0.196 (0.02)	0.119 (-0.11)	0.604 (0.02)	0.134 (-0.48)
OS	0.026 (-0.20)	0.198 (-0.09)	0.045 (0.13)	0.139 (0.07)	0.098 (0.11)	0.220 (-0.17)	0.424 (0.02)	0.158 (-0.11)	0.902 (0)	0.397 (-0.25)
OT	0.268 (-0.04)	0.059 (-0.13)	0.510 (0.05)	5.35E-03 (0.11)	3.17E-03 (0.14)	0.100 (-0.21)	0.577 (0.01)	0.308 (-0.07)	0.086 (-0.05)	0.476 (-0.19)
OI	0.029 (-0.20)	3.41E-06 (-0.36)	0.203 (0.08)	0.493 (0.03)	0.613 (0.03)	0.086 (-0.24)	0.073 (0.03)	0.283 (-0.08)	0.096 (-0.05)	0.012 (-0.74)

The association was corrected by age, gender and axial length.

Data are presented as P-values (Correlation coefficient).

A Bonferroni-corrected significance with a P-value <0.0056 was marked in bold.

RNFL: retinal nerve fiber layer; GC-IPL: ganglion cell-inner plexiform layer; SBP: systolic blood pressure; DBP: diastolic blood pressure; RPE/BM: retinal pigment epithelium-Bruch's membrane; GCL: ganglion cell layer; IPL: inner plexiform layer; INL: inner nuclear layer;

The ETDRS subfields include fovea (F), inner nasal (IN), inner superior (IS), inner temporal (IT), inner inferior (II), outer nasal (ON), outer superior (OS), outer temporal (OT), and outer inferior (OI) subfields.

Table 4. Associations (multivariate analysis) between diastolic blood pressure and the thickness of 9 retinal layers in each Early Treatment Diabetic Retinopathy Study (ETDRS) grid sector with adjustments for age, sex and axial length.

	RNFL	GCL	IPL	INL	OPL	ONL/ELM	EZ	POS	RPE/BM	Total Retina
F	0.218 (-0.06)	0.077 (-0.19)	0.035 (-0.19)	0.757 (0.02)	0.013 (-0.19)	2.38E-03 (0.54)	8.59E-03 (0.03)	0.343 (-0.07)	0.117 (-0.05)	0.634 (-0.17)
IN	0.477 (-0.04)	0.020 (-0.29)	0.257 (0.11)	0.017 (0.12)	0.027 (-0.40)	0.013 (0.61)	0.019 (0.04)	0.814 (-0.02)	0.068 (-0.07)	0.851 (0.06)
IS	3.92E-03 (-0.20)	0.261 (-0.12)	0.799 (0.02)	0.049 (0.09)	0.753 (0.04)	0.369 (0.17)	0.025 (0.03)	0.755 (0.02)	0.078 (-0.06)	0.999 (0.00)
IT	0.432 (0.03)	0.629 (0.05)	0.310 (-0.09)	1.20E-04 (0.17)	9.35E-03 (0.13)	0.926 (0.01)	0.341 (0.01)	0.799 (0.02)	0.052 (-0.07)	0.361 (0.27)
II	0.285 (-0.07)	0.030 (-0.23)	0.795 (0.02)	9.85E-03 (0.11)	0.163 (-0.13)	0.389 (0.14)	0.050 (0.03)	0.830 (-0.01)	0.057 (-0.06)	0.537 (-0.20)
ON	9.01E-04 (-0.26)	2.57E-03 (-0.29)	0.217 (0.09)	0.265 (0.05)	0.452 (-0.09)	0.573 (0.11)	0.289 (0.02)	0.638 (0.03)	0.255 (-0.04)	0.238 (-0.38)
OS	0.015 (-0.22)	0.570 (-0.04)	0.126 (0.10)	0.037 (0.09)	0.201 (0.09)	0.596 (-0.08)	0.855 (0)	0.651 (0.04)	0.063 (-0.05)	0.836 (-0.06)
OT	0.223 (-0.05)	0.600 (-0.04)	0.569 (0.04)	1.27E-03 (0.13)	1.49E-03 (0.15)	0.341 (-0.12)	0.648 (-0.01)	0.145 (0.1)	8.02E-04 (-0.1)	0.695 (0.11)
OI	0.012 (-0.23)	4.97E-04 (-0.27)	0.774 (0.02)	0.328 (0.04)	0.647 (-0.03)	0.763 (-0.04)	0.421 (0.02)	0.350 (0.07)	9.93E-03 (-0.08)	0.092 (-0.50)

The association was corrected by age, gender and axial length.

Data are presented as P-values (Correlation coefficient).

A Bonferroni-corrected significance with a P-value <0.0056 was marked in bold.

RNFL: retinal nerve fiber layer; GC-IPL: ganglion cell-inner plexiform layer; SBP: systolic blood pressure; DBP: diastolic blood pressure; RPE/BM: retinal pigment epithelium-Bruch's membrane; GCL: ganglion cell layer; IPL: inner plexiform layer; INL: inner nuclear layer; OPL: outer plexiform layer; ONL/ELM: outer nuclear layer/external limiting membrane; EZ: ellipsoid zone; POS: photoreceptor outer segments.

The ETDRS subfields include fovea (F), inner nasal (IN), inner superior (IS), inner temporal (IT), inner inferior (II), outer nasal (ON), outer superior (OS), outer temporal (OT), and outer inferior (OI) subfields.

Figure 1. Retinal layer segmentations in an optical coherence tomography B-scan. Nine layers of the retina were segmented, including the retinal nerve fiber layer (RNFL), ganglion cell layer (GCL), inner plexiform layer (IPL), inner nuclear layer (INL), outer plexiform layer (OPL), outer nuclear layer/external limiting membrane (ONL/ELM), ellipsoid zone (EZ), photoreceptor outer segments (POS), and retinal pigment epithelium-Bruch membrane (RPE/BM).

Figure 2. Retinal layers associated with systolic or diastolic blood pressure after multivariate analysis.

The strength of the association between layer thickness in each ETDRS sector and the systolic/diastolic blood pressure is depicted by the standard correlation coefficient (marked in the figure) in a multivariate regression analysis, with correcting the effect of age, gender, axial length and intraocular pressure. Blue and pink represent a positive and a negative relationship, respectively. A subfield that achieved a significance with a P-value <0.0056 is marked in green, while a subfield with a P-value <0.05 is marked in orange.

With an increase of systolic blood pressure, the thickness of the ganglion cell layer (GCL) and the photoreceptor outer segments (POS) decreased and the inner nuclear layer (INL) thickness increased (upper figure). With an increase of diastolic blood pressure, the thickness of GCL and retinal nerve fiber layer (RNFL) decreased, and the INL thickness increased (lower figure).

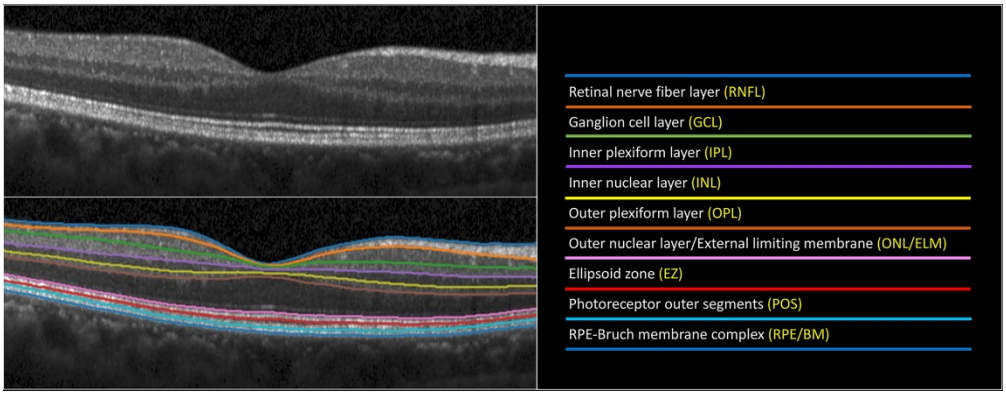

Figure 1. Retinal layer segmentations in an optical coherence tomography B-scan.
Nine layers of the retina were segmented, including the retinal nerve fiber layer (RNFL), ganglion cell layer (GCL), inner plexiform layer (IPL), inner nuclear layer (INL), outer plexiform layer (OPL), outer nuclear layer/external limiting membrane (ONL/ELM), ellipsoid zone (EZ), photoreceptor outer segments (POS), and retinal pigment epithelium-Bruch membrane (RPE/BM).

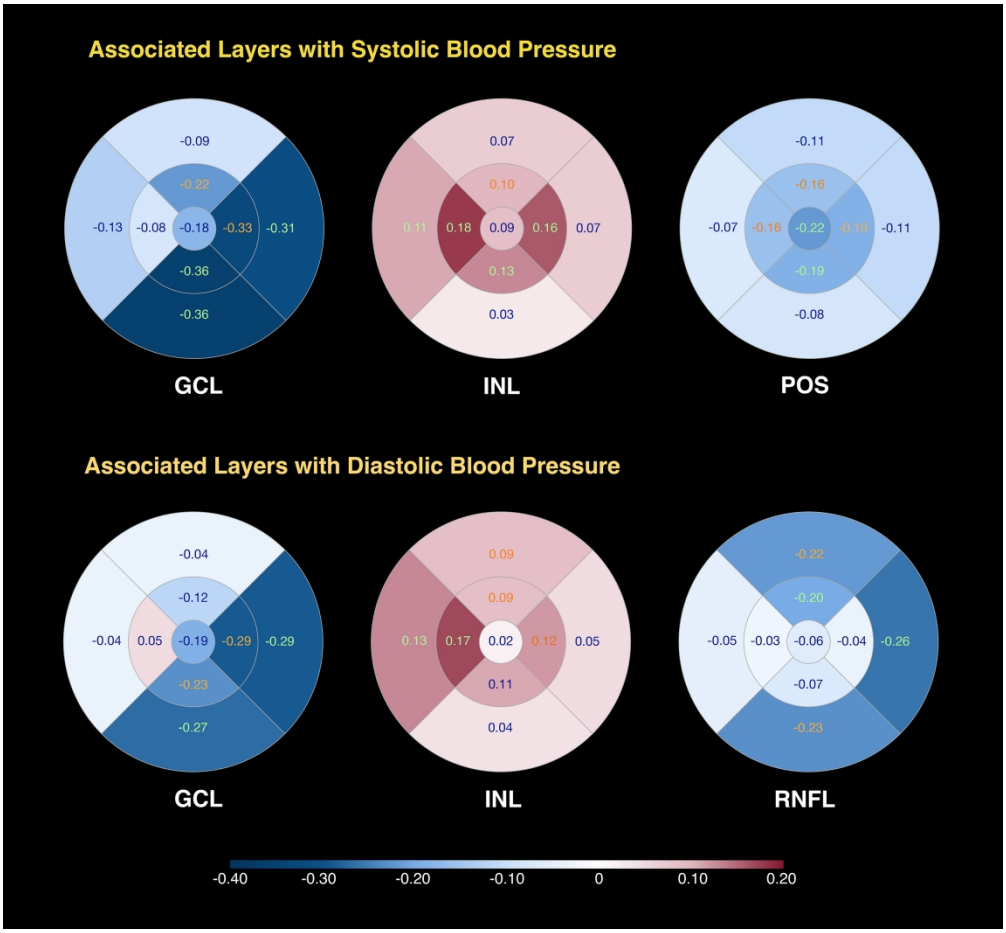

Figure 2. Retinal layers associated with systolic or diastolic blood pressure after multivariate analysis. The strength of the association between layer thickness in each ETDRS sector and the systolic/diastolic blood pressure is depicted by the standard correlation coefficient (marked in the figure) in a multivariate regression analysis, with correcting the effect of age, gender, axial length and intraocular pressure. Blue and pink represent a positive and a negative relationship, respectively. A subfield that achieved a significance with a P-value <0.0056 is marked in green, while a subfield with a P-value <0.05 is marked in orange. With an increase of systolic blood pressure, the thickness of the ganglion cell layer (GCL) and the photoreceptor outer segments (POS) decreased and the inner nuclear layer (INL) thickness increased (upper figure). With an increase of diastolic blood pressure, the thickness of GCL and retinal nerve fiber layer (RNFL) decreased, and the INL thickness increased (lower figure).

Supplementary Table 1: Association between the thickness of top 3 retinal layers (RNFL, GCL, IPL) in each ETDRS subfield with systematical and ocular parameters in a univariate linear regression

Layer	Univariable	F	IN	IS	IT	II	ON	OS	OT	OI
RNFL	Age	8.24E-02 (0.01)	5.25E-03 (-0.02**)	2.82E-10 (-0.05**)	3.08E-22 (-0.05**)	1.60E-11 (-0.05**)	4.05E-03 (-0.03**)	1.95E-06 (-0.05**)	2.62E-06 (-0.02**)	8.06E-04 (-0.04**)
	Gender	2.99E-29 (-1.18**)	1.01E-08 (-0.65**)	1.33E-06 (-0.67**)	1.69E-01 (-0.11)	8.98E-01 (0.02)	5.74E-02 (-0.30)	7.95E-03 (0.48**)	7.70E-01 (-0.02)	8.43E-11 (1.19**)
	Axial Length	8.60E-31 (0.71**)	1.28E-32 (0.79**)	5.52E-22 (0.78**)	1.08E-03 (0.16**)	1.35E-12 (0.56**)	2.55E-24 (0.95**)	1.01E-05 (0.47**)	1.81E-02 (-0.11*)	1.90E-06 (0.51**)
	IOP	8.76E-01 (0.00)	1.42E-02 (0.06*)	4.41E-02 (0.06*)	1.69E-01 (0.02)	6.97E-01 (0.01)	3.26E-01 (0.03)	6.33E-01 (0.02)	8.38E-01 (-0.00)	5.95E-02 (-0.07)
	Height	9.74E-23 (0.07**)	1.47E-12 (0.05**)	7.08E-15 (0.07**)	6.17E-05 (0.02**)	6.16E-04 (0.03**)	8.41E-07 (0.05**)	9.67E-02 (0.02)	2.75E-02 (0.01*)	2.10E-01 (-0.01)
	Weight	6.88E-05 (0.02**)	1.86E-02 (0.01*)	4.82E-02 (0.01*)	3.92E-04 (0.01**)	5.80E-01 (0.00)	7.15E-01 (-0.00)	8.16E-01 (-0.00)	1.89E-01 (0.00)	1.01E-02 (-0.02*)
	BMI	5.31E-02 (-0.03)	4.42E-02 (-0.03*)	4.99E-03 (-0.05**)	1.37E-01 (0.02)	1.17E-01 (-0.03)	2.12E-04 (-0.08**)	1.68E-01 (-0.03)	9.80E-01 (0.00)	3.39E-02 (-0.05*)
	Waist circumference	1.85E-01 (0.01)	3.54E-01 (-0.01)	1.98E-02 (-0.02*)	6.32E-01 (0.00)	1.00E-02 (-0.02*)	9.89E-05 (-0.03**)	3.93E-04 (-0.03**)	4.09E-01 (-0.00)	1.62E-06 (-0.04**)
	Hip circumference	4.54E-01 (-0.01)	1.50E-01 (-0.01)	8.43E-02 (-0.02)	2.23E-01 (0.01)	1.10E-01 (-0.01)	1.33E-03 (-0.03**)	1.36E-01 (-0.02)	3.00E-01 (-0.01)	2.08E-02 (-0.03*)
	SBP	4.27E-01 (-0.00)	6.43E-02 (-0.01)	4.40E-05 (-0.01**)	3.23E-01 (-0.00)	1.84E-03 (-0.01**)	2.08E-05 (-0.02**)	2.39E-04 (-0.02**)	1.44E-01 (-0.00)	2.26E-04 (-0.02**)
	DBP	5.21E-01 (-0.00)	7.86E-01 (-0.00)	9.80E-02 (-0.01)	1.76E-02 (0.01*)	6.36E-01 (-0.00)	1.32E-03 (-0.02**)	2.03E-02 (-0.02*)	9.21E-01 (-0.00)	1.07E-03 (-0.02**)
	Hypertension	2.58E-02 (-0.24*)	3.68E-03 (-0.33**)	2.39E-05 (-0.58**)	4.86E-03 (-0.23**)	8.53E-05 (-0.53**)	4.18E-04 (-0.56**)	3.65E-03 (-0.52**)	6.11E-02 (-0.14)	7.05E-03 (-0.49**)
	Glucose	8.91E-01 (0.01)	7.29E-01 (0.02)	6.42E-01 (-0.03)	9.28E-02 (0.06)	5.75E-01 (0.03)	7.64E-01 (-0.02)	5.52E-01 (0.04)	4.02E-01 (0.03)	6.69E-01 (0.03)
	Diabetes	4.41E-01 (-0.12)	2.81E-01 (-0.18)	1.12E-01 (-0.33)	9.45E-01 (-0.01)	5.51E-01 (-0.12)	8.84E-01 (-0.03)	8.88E-01 (-0.04)	9.63E-01 (0.01)	8.23E-01 (-0.06)
	Cholesterol	2.17E-02 (-0.14*)	5.22E-01 (-0.04)	2.44E-01 (-0.10)	7.78E-01 (0.01)	6.36E-01 (0.04)	4.72E-01 (-0.07)	2.85E-01 (0.12)	5.77E-01 (0.03)	3.96E-01 (0.09)
	HDL	6.03E-01 (0.08)	1.86E-01 (0.22)	6.25E-01 (-0.10)	3.26E-01 (0.12)	5.24E-01 (0.13)	6.40E-01 (0.11)	4.42E-01 (-0.20)	8.51E-01 (0.02)	6.71E-01 (-0.11)
	LDL	2.53E-01 (-0.08)	7.92E-01 (-0.02)	7.50E-01 (-0.03)	1.29E-01 (0.08)	2.11E-01 (0.11)	6.08E-01 (-0.05)	2.70E-01 (0.13)	2.82E-01 (0.05)	1.68E-01 (0.17)
	TG	2.28E-04 (-0.18**)	1.02E-02 (-0.14*)	1.12E-01 (-0.10)	1.11E-01 (-0.06)	1.16E-01 (-0.10)	4.92E-02 (-0.15*)	4.19E-01 (0.07)	7.50E-01 (-0.01)	4.64E-01 (-0.06)
GCL	Age	8.37E-03 (-0.03**)	6.70E-10 (-0.09**)	7.80E-21 (-0.11**)	9.66E-23 (-0.12**)	2.22E-21 (-0.12**)	1.12E-49 (-0.17**)	4.64E-23 (-0.08**)	3.81E-29 (-0.09**)	2.49E-19 (-0.08**)
	Gender	8.73E-16 (-1.77**)	8.50E-01 (0.05)	6.04E-02 (0.39)	1.12E-01 (0.34)	5.79E-03 (0.58**)	2.60E-08 (1.11**)	1.67E-18 (1.27**)	8.06E-06 (0.63**)	1.08E-08 (0.90**)
	Axial Length	6.17E-26 (1.35**)	2.72E-07 (0.75**)	1.20E-01 (0.19)	5.14E-04 (0.43**)	2.71E-01 (0.14)	1.82E-13 (-0.86**)	7.88E-27 (-0.90**)	4.23E-02 (-0.17*)	1.25E-12 (-0.65**)
	IOP	1.73E-01 (0.06)	1.10E-01 (0.08)	2.79E-02 (0.09*)	1.03E-01 (0.07)	1.09E-01 (0.07)	5.69E-02 (0.07)	9.76E-01 (-0.00)	3.85E-01 (0.02)	7.78E-01 (0.01)
	Height	1.23E-17 (0.12**)	1.58E-02 (0.04*)	2.42E-01 (0.02)	2.42E-02 (0.03*)	5.45E-01 (0.01)	6.04E-03 (-0.03**)	7.32E-10 (-0.06**)	8.49E-01 (-0.00)	2.14E-03 (-0.03**)
	Weight	2.11E-02 (0.02*)	4.63E-01 (-0.01)	2.66E-01 (-0.01)	3.85E-01 (0.01)	4.51E-02 (-0.02*)	3.40E-03 (-0.03**)	1.22E-03 (-0.02**)	9.94E-01 (-0.00)	7.31E-04 (-0.02**)
	BMI	2.69E-03 (-0.09**)	1.42E-02 (-0.08*)	5.14E-02 (-0.05)	6.94E-01 (-0.01)	1.14E-02 (-0.07*)	1.47E-01 (-0.04)	6.64E-01 (0.01)	8.15E-01 (0.00)	1.01E-01 (-0.03)
	Waist circumference	2.36E-01 (-0.01)	2.42E-04 (-0.04**)	1.09E-03 (-0.03**)	8.15E-02 (-0.02)	1.03E-05 (-0.04**)	3.46E-06 (-0.04**)	5.70E-03 (-0.02**)	1.86E-02 (-0.02*)	7.65E-06 (-0.03**)
	Hip circumference	7.37E-02 (-0.03)	1.07E-01 (-0.03)	2.66E-01 (-0.02)	7.23E-01 (0.01)	1.02E-01 (-0.02)	1.28E-01 (-0.02)	8.03E-01 (-0.00)	8.93E-01 (0.00)	1.65E-01 (-0.01)

GCL	SBP	3.40E-03 (-0.02**)	2.07E-05 (-0.03**)	1.15E-04 (-0.02**)	5.45E-03 (-0.01**)	2.87E-07 (-0.03**)	4.13E-06 (-0.02**)	7.06E-02 (-0.01)	4.41E-04 (-0.01**)	2.05E-07 (-0.02**)
	DBP	4.20E-01 (-0.01)	1.04E-01 (-0.02)	9.07E-01 (0.00)	1.09E-01 (0.01)	3.36E-01 (-0.01)	6.29E-01 (-0.00)	4.82E-01 (0.00)	3.68E-01 (0.01)	4.22E-02 (-0.01*)
	Hypertension	1.18E-04 (-0.84**)	7.21E-05 (-0.98**)	4.91E-07 (-1.03**)	2.51E-05 (-0.88**)	1.59E-08 (-1.17**)	1.55E-05 (-0.86**)	2.17E-03 (-0.44**)	8.18E-05 (-0.55**)	4.30E-06 (-0.72**)
	Glucose	1.82E-01 (-0.12)	2.11E-01 (-0.12)	4.62E-01 (-0.06)	3.90E-01 (-0.07)	2.03E-01 (-0.11)	3.34E-01 (-0.08)	4.22E-01 (0.05)	2.54E-01 (-0.07)	9.18E-01 (-0.01)
	Diabetes	2.84E-02 (-0.71*)	2.67E-02 (-0.81*)	2.01E-01 (-0.39)	1.81E-02 (-0.73*)	1.12E-01 (-0.49)	1.07E-01 (-0.47)	5.01E-01 (0.14)	1.06E-01 (-0.34)	6.22E-01 (-0.11)
	Cholesterol	1.00E-01 (-0.22)	1.98E-01 (0.19)	4.47E-01 (0.09)	9.76E-01 (0.00)	4.02E-01 (0.10)	5.45E-02 (0.23)	1.18E-02 (0.22*)	1.70E-01 (0.12)	7.74E-02 (0.17)
	HDL	8.78E-01 (0.05)	2.03E-01 (0.46)	4.06E-01 (0.25)	6.46E-01 (0.14)	3.67E-02 (0.64*)	1.37E-01 (0.43)	1.36E-02 (0.52*)	7.90E-01 (0.06)	9.19E-02 (0.39)
	LDL	4.97E-01 (-0.10)	9.35E-02 (0.27)	1.96E-01 (0.17)	4.84E-01 (0.10)	3.56E-01 (0.13)	4.21E-02 (0.27*)	1.62E-02 (0.23*)	1.47E-01 (0.14)	5.68E-02 (0.20)
	TG	1.35E-02 (-0.25*)	1.03E-01 (-0.19)	4.54E-01 (-0.07)	5.41E-01 (-0.06)	2.04E-01 (-0.12)	4.87E-01 (-0.06)	8.55E-01 (-0.01)	5.18E-01 (0.04)	3.79E-01 (-0.07)
IPL	Age	1.48E-06 (-0.05**)	1.11E-26 (-0.12**)	3.77E-47 (-0.16**)	2.30E-26 (-0.12**)	1.79E-50 (-0.16**)	1.63E-54 (-0.14**)	7.63E-84 (-0.16**)	6.76E-50 (-0.14**)	2.80E-92 (-0.17**)
	Gender	1.71E-19 (-1.62**)	5.20E-05 (-0.78**)	7.11E-01 (-0.07)	4.13E-07 (-0.95**)	7.97E-01 (0.05)	4.48E-01 (-0.12)	1.30E-03 (0.46**)	4.37E-04 (-0.59**)	2.74E-03 (0.43**)
	Axial Length	6.59E-09 (0.62**)	1.27E-02 (0.28*)	9.26E-05 (-0.43**)	5.40E-04 (-0.38**)	4.83E-02 (-0.22*)	1.22E-01 (-0.14)	2.05E-24 (-0.84**)	1.38E-21 (-0.93**)	1.70E-12 (-0.60**)
	IOP	1.93E-01 (0.05)	3.07E-02 (0.08*)	5.66E-02 (0.07)	1.94E-02 (0.09*)	5.59E-02 (0.07)	1.22E-02 (0.08*)	6.34E-02 (0.05)	7.36E-03 (0.09**)	1.40E-02 (0.07*)
	Height	2.60E-19 (0.10**)	9.21E-09 (0.07**)	4.64E-03 (0.03**)	8.77E-09 (0.07**)	5.36E-02 (0.02)	6.74E-03 (0.03**)	7.18E-01 (-0.00)	4.37E-05 (0.04**)	5.51E-01 (-0.01)
	Weight	6.10E-06 (0.04**)	1.65E-05 (0.04**)	4.99E-04 (0.03**)	5.44E-04 (0.03**)	1.33E-03 (0.03**)	1.61E-03 (0.02**)	5.32E-04 (0.02**)	2.91E-04 (0.03**)	8.58E-03 (0.02**)
	BMI	4.31E-01 (-0.02)	2.45E-01 (0.03)	3.33E-02 (0.05*)	8.34E-01 (0.01)	2.02E-02 (0.06*)	5.44E-02 (0.04)	2.24E-05 (0.08**)	1.28E-01 (0.03)	6.64E-04 (0.06**)
	Waist circumference	3.90E-01 (0.01)	1.28E-01 (0.01)	7.54E-01 (0.00)	7.27E-01 (-0.00)	5.71E-01 (0.01)	5.40E-01 (0.00)	2.74E-01 (0.01)	8.95E-01 (0.00)	5.46E-01 (0.00)
	Hip circumference	3.06E-01 (-0.01)	3.96E-01 (0.01)	1.54E-01 (0.02)	9.10E-01 (-0.00)	7.30E-02 (0.02)	2.72E-01 (0.01)	1.56E-03 (0.03**)	3.98E-01 (0.01)	3.60E-03 (0.03**)
	SBP	3.58E-01 (-0.00)	3.65E-01 (0.00)	7.80E-01 (-0.00)	4.98E-01 (-0.00)	6.82E-01 (-0.00)	8.73E-01 (-0.00)	9.41E-01 (0.00)	9.00E-01 (-0.00)	2.67E-01 (-0.00)
	DBP	8.48E-01 (-0.00)	7.59E-04 (0.03**)	1.81E-03 (0.02**)	4.32E-02 (0.02*)	3.32E-03 (0.02**)	4.79E-05 (0.03**)	6.09E-07 (0.03**)	7.84E-06 (0.03**)	1.40E-04 (0.02**)
	Hypertension	3.08E-01 (-0.18)	2.03E-01 (-0.24)	9.34E-02 (-0.31)	9.90E-02 (-0.31)	3.86E-01 (-0.16)	1.38E-02 (-0.38*)	1.26E-01 (-0.22)	1.79E-02 (-0.39*)	1.35E-01 (-0.22)
	Glucose	4.30E-01 (0.06)	8.27E-01 (0.02)	8.49E-01 (0.01)	6.66E-01 (-0.03)	5.75E-01 (0.04)	9.99E-01 (-0.00)	9.71E-01 (-0.00)	6.03E-01 (0.03)	7.07E-01 (0.02)
	Diabetes	8.88E-01 (-0.04)	7.21E-01 (-0.10)	3.81E-01 (-0.24)	7.39E-01 (-0.09)	6.41E-01 (-0.13)	4.35E-01 (-0.18)	4.41E-01 (-0.16)	7.06E-01 (-0.09)	6.26E-01 (-0.10)
	Cholesterol	1.87E-02 (-0.25*)	3.55E-01 (-0.11)	7.86E-01 (0.03)	5.39E-01 (-0.07)	7.86E-01 (-0.03)	2.78E-01 (0.10)	2.96E-01 (0.09)	5.61E-01 (-0.06)	7.36E-01 (0.03)
	HDL	7.87E-01 (-0.07)	6.44E-01 (-0.13)	2.99E-01 (0.28)	3.84E-01 (0.24)	6.81E-01 (-0.11)	5.12E-01 (0.15)	1.30E-01 (0.32)	1.45E-01 (0.35)	4.03E-01 (0.18)
	LDL	5.35E-02 (-0.23)	6.66E-01 (-0.05)	4.77E-01 (0.09)	9.12E-01 (-0.01)	5.60E-01 (0.07)	1.19E-01 (0.16)	1.29E-01 (0.14)	8.36E-01 (0.02)	2.63E-01 (0.11)
	TG	8.99E-02 (-0.14)	8.36E-01 (-0.02)	3.23E-01 (-0.09)	1.64E-01 (-0.12)	4.89E-01 (-0.06)	8.59E-01 (-0.01)	7.58E-01 (-0.02)	3.83E-02 (-0.16*)	2.81E-01 (-0.07)

Data are presented as P-value (Correlation coefficient)
*significant at the 0.05 level (2-tailed); **significant at the 0.01 level (2-tailed).
IOP: intraocular pressure; BMI: body mass index; SBP: systolic blood pressure; DBP: diastolic blood pressure; HDL: high density lipoprotein; LDL: low density lipoprotein; TG: triglyceride

Supplementary Table 2: Association between the thickness of middle 3 retinal layers (INL, OPL, ONL/ELM) in each ETDRS subfield with systematical and ocular parameters in a univariate linear regression

Layer	Univariable	F	IN	IS	IT	II	ON	OS	OT	OI
INL	Age	4.47E-14 (-0.05**)	9.37E-48 (-0.08**)	1.56E-105 (-0.13**)	2.35E-102 (-0.12**)	3.20E-114 (-0.12**)	8.86E-119 (-0.13**)	1.51E-102 (-0.12**)	3.09E-118 (-0.12**)	1.88E-116 (-0.12**)
	Gender	5.19E-38 (-1.53**)	1.26E-07 (-0.53**)	5.40E-03 (-0.29**)	3.42E-08 (-0.55**)	5.79E-02 (-0.18)	5.63E-02 (0.19)	2.40E-06 (0.48**)	6.27E-02 (-0.17)	1.82E-03 (0.30**)
	Axial Length	1.65E-12 (0.50**)	5.15E-01 (0.04)	3.82E-05 (-0.25**)	2.39E-03 (-0.18**)	1.93E-06 (-0.27**)	4.82E-23 (-0.58**)	1.55E-40 (-0.78**)	1.49E-20 (-0.50**)	5.99E-27 (-0.60**)
	IOP	8.12E-03 (0.06**)	4.22E-06 (0.09**)	3.28E-04 (0.07**)	1.88E-04 (0.07**)	5.20E-05 (0.08**)	1.00E-03 (0.06**)	1.20E-01 (0.03)	2.09E-04 (0.07**)	1.43E-02 (0.05*)
	Height	1.57E-35 (0.09**)	5.36E-12 (0.04**)	7.38E-08 (0.04**)	1.58E-16 (0.05**)	5.61E-06 (0.03**)	7.43E-01 (0.00)	8.11E-02 (-0.01)	2.38E-06 (0.03**)	6.04E-01 (-0.00)
	Weight	1.60E-11 (0.04**)	3.86E-07 (0.02**)	6.95E-09 (0.03**)	7.02E-15 (0.03**)	1.10E-08 (0.02**)	5.34E-02 (0.01)	2.73E-02 (0.01*)	5.87E-11 (0.03**)	2.08E-02 (0.01*)
	BMI	6.71E-01 (-0.01)	2.01E-01 (0.02)	1.36E-03 (0.04**)	3.88E-04 (0.05**)	2.82E-04 (0.05**)	3.00E-02 (0.03*)	1.25E-04 (0.05**)	7.96E-06 (0.05**)	1.62E-03 (0.04**)
	Waist circumference	3.53E-02 (0.01*)	3.79E-01 (0.00)	1.71E-01 (0.01)	6.61E-03 (0.01**)	6.91E-02 (0.01)	4.35E-01 (-0.00)	7.03E-01 (0.00)	1.59E-02 (0.01*)	8.99E-01 (-0.00)
	Hip circumference	7.05E-01 (0.00)	2.12E-01 (0.01)	7.62E-03 (0.02**)	1.74E-04 (0.03**)	1.83E-04 (0.02**)	1.57E-01 (0.01)	3.86E-03 (0.02**)	2.91E-05 (0.03**)	3.81E-03 (0.02**)
	SBP	9.03E-01 (0.00)	2.92E-01 (0.00)	5.54E-01 (-0.00)	2.78E-01 (0.00)	9.22E-01 (0.00)	3.74E-01 (-0.00)	6.88E-01 (-0.00)	7.17E-01 (0.00)	1.32E-01 (-0.00)
	DBP	2.26E-03 (0.01**)	3.83E-08 (0.02**)	6.14E-10 (0.03**)	4.77E-16 (0.03**)	1.50E-11 (0.03**)	9.00E-08 (0.02**)	8.45E-09 (0.02**)	1.37E-14 (0.03**)	3.95E-07 (0.02**)
	Hypertension	1.46E-02 (-0.29*)	7.51E-03 (-0.27**)	2.65E-05 (-0.43**)	4.67E-04 (-0.35**)	1.20E-03 (-0.31**)	8.14E-05 (-0.39**)	2.94E-03 (-0.30**)	5.34E-03 (-0.25**)	2.92E-03 (-0.28**)
	Glucose	5.79E-01 (0.03)	2.92E-01 (0.04)	5.24E-01 (0.03)	9.09E-01 (0.00)	4.57E-01 (0.03)	8.70E-01 (-0.01)	3.74E-01 (0.04)	6.85E-01 (0.01)	8.77E-01 (0.01)
	Diabetes	2.47E-01 (-0.21)	9.92E-02 (-0.24)	1.87E-01 (-0.20)	8.22E-02 (-0.26)	1.91E-01 (-0.19)	1.56E-01 (-0.21)	8.46E-01 (-0.03)	4.24E-01 (-0.11)	2.40E-01 (-0.17)
	Cholesterol	4.50E-03 (-0.20**)	7.88E-01 (-0.02)	8.86E-01 (0.01)	6.80E-01 (-0.02)	8.53E-01 (-0.01)	2.19E-01 (0.07)	1.49E-01 (0.09)	8.80E-01 (-0.01)	3.45E-01 (0.05)
	HDL	5.12E-01 (0.12)	6.99E-02 (0.27)	1.26E-01 (0.23)	3.14E-02 (0.31*)	9.94E-02 (0.23)	5.00E-02 (0.28*)	2.19E-02 (0.34*)	1.13E-01 (0.21)	1.24E-01 (0.21)
	LDL	3.34E-02 (-0.17*)	9.48E-01 (0.00)	4.71E-01 (0.05)	6.79E-01 (0.03)	5.45E-01 (0.04)	1.81E-01 (0.09)	1.22E-01 (0.10)	5.67E-01 (0.03)	1.14E-01 (0.10)
	TG	6.26E-03 (-0.15**)	4.95E-02 (-0.09*)	1.24E-01 (-0.07)	2.51E-02 (-0.10*)	5.26E-02 (-0.09)	5.00E-01 (-0.03)	7.32E-01 (-0.02)	1.46E-01 (-0.06)	2.41E-01 (-0.05)
OPL	Age	6.56E-29 (0.10**)	1.85E-27 (0.23**)	2.04E-08 (0.08**)	8.16E-01 (-0.00)	4.19E-04 (0.04**)	1.11E-15 (0.11**)	4.06E-01 (0.01)	1.97E-02 (-0.01*)	2.39E-01 (-0.01)
	Gender	1.10E-02 (-0.40*)	3.72E-02 (0.77*)	6.04E-03 (0.64**)	1.71E-04 (-0.36**)	3.38E-01 (-0.17)	3.34E-01 (0.23)	3.17E-04 (0.49**)	2.17E-01 (-0.11)	6.19E-01 (0.06)
	Axial Length	4.45E-29 (1.03**)	1.85E-17 (1.82**)	4.59E-02 (0.27*)	2.55E-04 (0.21**)	5.00E-09 (0.62**)	1.23E-12 (1.00**)	7.68E-02 (-0.14)	3.73E-01 (0.05)	3.43E-03 (0.20**)
	IOP	6.12E-01 (-0.02)	3.66E-01 (-0.07)	2.59E-01 (-0.05)	9.00E-01 (0.00)	9.61E-01 (0.00)	3.22E-01 (-0.05)	1.10E-01 (-0.04)	8.95E-01 (0.00)	5.82E-01 (0.01)
	Height	1.58E-01 (0.01)	6.60E-02 (-0.04)	8.55E-05 (-0.06**)	1.13E-03 (0.02**)	3.84E-01 (0.01)	4.70E-01 (-0.01)	2.24E-04 (-0.03**)	6.83E-02 (0.01)	7.31E-01 (0.00)
	Weight	1.04E-01 (-0.01)	3.57E-03 (-0.05**)	8.90E-04 (-0.03**)	8.24E-04 (0.01**)	8.11E-01 (0.00)	2.26E-01 (-0.01)	8.67E-02 (-0.01)	6.00E-04 (0.01**)	1.91E-01 (0.01)
	BMI	2.54E-03 (-0.06**)	1.68E-02 (-0.12*)	1.83E-01 (-0.04)	8.61E-02 (0.02)	7.36E-01 (-0.01)	2.64E-01 (-0.04)	6.94E-01 (0.01)	6.88E-03 (0.03**)	1.92E-01 (0.02)
	Waist circumference	5.44E-02 (-0.01)	4.58E-03 (-0.05**)	5.03E-02 (-0.02)	1.44E-02 (0.01*)	2.88E-01 (-0.01)	1.42E-01 (-0.02)	7.23E-01 (-0.00)	3.21E-03 (0.01**)	8.18E-01 (0.00)
	Hip circumference	1.59E-03 (-0.03**)	1.16E-03 (-0.08**)	1.53E-02 (-0.04*)	1.99E-02 (0.02*)	8.02E-01 (-0.00)	3.42E-02 (-0.03*)	5.60E-01 (-0.01)	1.72E-03 (0.02**)	9.68E-02 (0.01)

OPL	SBP	9.76E-01 (0.00)	7.61E-01 (-0.00)	3.07E-01 (0.01)	4.90E-02 (0.00*)	6.68E-01 (-0.00)	5.48E-01 (0.00)	7.83E-02 (0.01)	1.31E-02 (0.01*)	9.01E-01 (-0.00)
	DBP	1.58E-06 (-0.03**)	4.79E-07 (-0.07**)	1.93E-01 (-0.01)	4.35E-03 (0.01**)	2.04E-02 (-0.02*)	3.85E-03 (-0.03**)	5.08E-01 (0.00)	2.92E-04 (0.01**)	5.66E-01 (-0.00)
	Hypertension	1.48E-01 (0.23)	4.92E-03 (1.02**)	1.81E-01 (0.31)	9.79E-01 (0.00)	9.12E-01 (0.02)	2.17E-03 (0.73**)	1.50E-01 (0.19)	2.65E-01 (0.10)	5.92E-01 (0.06)
	Glucose	3.52E-01 (0.06)	5.54E-01 (-0.08)	1.49E-01 (0.13)	8.74E-01 (0.01)	8.04E-01 (-0.02)	9.92E-01 (-0.00)	2.34E-02 (0.12*)	7.42E-01 (0.01)	9.56E-01 (-0.00)
	Diabetes	3.18E-01 (0.23)	7.28E-01 (0.19)	1.16E-01 (0.54)	4.42E-01 (0.11)	2.64E-01 (0.30)	2.70E-01 (0.39)	5.58E-02 (0.38)	2.28E-01 (0.16)	5.99E-01 (0.09)
	Cholesterol	6.07E-02 (-0.17)	6.66E-01 (-0.09)	2.04E-01 (0.17)	4.35E-01 (-0.05)	1.99E-01 (-0.14)	5.41E-01 (-0.08)	2.42E-01 (0.09)	4.84E-01 (-0.04)	2.78E-01 (-0.08)
	HDL	8.55E-01 (-0.04)	6.32E-01 (-0.24)	1.60E-01 (0.47)	1.34E-01 (0.21)	5.51E-01 (-0.16)	3.89E-01 (-0.29)	1.18E-01 (0.31)	1.34E-01 (0.20)	9.76E-01 (-0.01)
	LDL	1.57E-02 (-0.24*)	1.85E-01 (-0.30)	6.28E-01 (0.07)	7.88E-01 (-0.02)	1.79E-01 (-0.16)	1.78E-01 (-0.20)	6.28E-01 (0.04)	8.82E-01 (-0.01)	4.56E-01 (-0.06)
	TG	1.88E-01 (-0.09)	7.91E-01 (0.04)	5.41E-01 (-0.07)	7.78E-03 (-0.12**)	7.21E-01 (-0.03)	5.35E-01 (0.07)	8.04E-01 (-0.02)	2.46E-02 (-0.10*)	4.21E-01 (-0.04)
ONL/ELM	Age	2.36E-36 (-0.27**)	1.07E-51 (-0.46**)	5.26E-34 (-0.27**)	4.18E-21 (-0.16**)	4.60E-43 (-0.28**)	5.21E-54 (-0.36**)	2.09E-37 (-0.22**)	2.09E-26 (-0.16**)	1.65E-47 (-0.25**)
	Gender	2.94E-15 (-2.92**)	1.69E-12 (-3.74**)	2.54E-11 (-2.56**)	7.06E-13 (-2.14**)	1.28E-08 (-1.97**)	3.94E-08 (-2.24**)	7.15E-10 (-1.82**)	1.77E-15 (-2.10**)	3.48E-09 (-1.74**)
	Axial Length	6.96E-09 (-1.26**)	3.29E-16 (-2.53**)	1.82E-08 (-1.27**)	1.98E-04 (-0.65**)	3.48E-13 (-1.48**)	2.34E-18 (-2.08**)	4.75E-09 (-1.02**)	8.43E-06 (-0.69**)	4.93E-15 (-1.34**)
	IOP	1.81E-02 (0.17*)	1.85E-02 (0.25*)	6.61E-03 (0.21**)	1.09E-03 (0.19**)	1.04E-02 (0.18*)	4.58E-03 (0.23**)	3.11E-03 (0.17**)	8.45E-04 (0.17**)	3.01E-03 (0.17**)
	Height	2.74E-10 (0.15**)	4.77E-08 (0.18**)	2.32E-10 (0.15**)	3.47E-09 (0.11**)	8.01E-07 (0.11**)	3.17E-05 (0.11**)	2.28E-07 (0.10**)	4.11E-10 (0.11**)	2.72E-06 (0.09**)
	Weight	7.52E-06 (0.07**)	2.76E-06 (0.11**)	1.11E-06 (0.08**)	1.56E-03 (0.04**)	1.27E-03 (0.05**)	1.44E-03 (0.06**)	5.65E-04 (0.04**)	1.67E-03 (0.04**)	7.41E-03 (0.03**)
	BMI	2.72E-01 (0.05)	4.99E-02 (0.14*)	1.43E-01 (0.07)	7.72E-01 (-0.01)	6.60E-01 (0.02)	3.04E-01 (0.06)	5.83E-01 (0.02)	6.10E-01 (-0.02)	9.47E-01 (-0.00)
	Waist circumference	1.57E-01 (0.03)	1.53E-02 (0.06*)	1.18E-01 (0.03)	4.99E-01 (-0.01)	7.40E-01 (0.01)	3.56E-01 (0.02)	6.69E-01 (0.01)	3.84E-01 (-0.01)	8.73E-01 (-0.00)
	Hip circumference	3.01E-01 (0.03)	2.25E-02 (0.08*)	6.88E-02 (0.05)	2.79E-01 (-0.02)	8.81E-01 (0.00)	1.83E-01 (0.04)	3.64E-01 (0.02)	2.93E-01 (-0.02)	7.77E-01 (-0.01)
	SBP	3.40E-01 (0.01)	8.43E-01 (0.00)	6.49E-01 (-0.00)	5.22E-01 (-0.00)	2.29E-01 (-0.01)	1.27E-01 (-0.02)	6.00E-02 (-0.01)	4.14E-02 (-0.01*)	2.13E-02 (-0.02*)
	DBP	1.52E-11 (0.10**)	2.54E-11 (0.14**)	6.50E-06 (0.07**)	1.28E-03 (0.04**)	2.38E-06 (0.07**)	1.48E-06 (0.08**)	1.21E-03 (0.04**)	8.09E-03 (0.03**)	1.12E-04 (0.05**)
	Hypertension	1.19E-01 (-0.58)	2.68E-03 (-1.59**)	3.48E-02 (-0.81*)	2.34E-01 (-0.35)	4.44E-02 (-0.69*)	2.05E-04 (-1.50**)	4.75E-03 (-0.83**)	1.39E-02 (-0.65*)	2.01E-03 (-0.90**)
	Glucose	1.56E-05 (-0.63**)	1.14E-01 (-0.32)	1.08E-02 (-0.39*)	1.77E-02 (-0.29*)	9.43E-02 (-0.23)	1.34E-01 (-0.24)	3.40E-02 (-0.25*)	4.74E-02 (-0.21*)	2.02E-01 (-0.15)
	Diabetes	1.77E-03 (-1.71**)	9.91E-02 (-1.29)	6.97E-02 (-1.03)	1.40E-01 (-0.65)	8.37E-02 (-0.88)	4.62E-02 (-1.20*)	7.70E-02 (-0.77)	1.28E-01 (-0.59)	9.91E-02 (-0.71)
	Cholesterol	6.45E-03 (-0.59**)	8.38E-02 (-0.52)	1.03E-02 (-0.59*)	1.22E-03 (-0.58**)	3.49E-02 (-0.44*)	2.04E-01 (-0.30)	4.45E-02 (-0.36*)	3.41E-03 (-0.47**)	1.85E-01 (-0.23)
	HDL	8.94E-01 (0.07)	6.22E-01 (0.37)	8.01E-01 (-0.14)	5.89E-01 (-0.24)	7.02E-01 (0.19)	3.72E-01 (0.52)	5.87E-01 (0.24)	8.75E-01 (-0.06)	4.02E-01 (0.36)
	LDL	7.64E-02 (-0.42)	5.84E-01 (-0.18)	1.34E-01 (-0.38)	6.31E-03 (-0.54**)	1.78E-01 (-0.31)	8.72E-01 (-0.04)	3.14E-01 (-0.20)	2.09E-02 (-0.41*)	5.04E-01 (-0.13)
	TG	7.80E-02 (-0.30)	8.28E-02 (-0.41)	1.75E-01 (-0.24)	1.67E-01 (-0.19)	4.83E-02 (-0.32*)	3.60E-02 (-0.39*)	4.50E-02 (-0.28*)	5.97E-02 (-0.24)	4.24E-02 (-0.28*)

Data are presented as P-value (Correlation coefficient)
*significant at the 0.05 level (2-tailed); **significant at the 0.01 level (2-tailed).
IOP: intraocular pressure; BMI: body mass index; SBP: systolic blood pressure; DBP: diastolic blood pressure; HDL: high density lipoprotein; LDL: low density lipoprotein; TG: triglyceride

Supplementary Table 3: Association between the thickness of bottom 3 retinal layers (EZ, POS, RPE/BM) in each ETDRS subfield with systematical and ocular parameters in a univariate linear regression

Layer	Univariable	F	IN	IS	IT	II	ON	OS	OT	OI
EZ	Age	6.09E-13 (-0.01**)	1.28E-07 (-0.01**)	6.28E-09 (0.01**)	5.39E-02 (0.00)	3.33E-02 (0.00*)	4.94E-05 (0.01**)	2.68E-26 (0.03**)	5.28E-33 (0.03**)	4.37E-47 (0.03**)
	Gender	7.04E-03 (0.06**)	2.33E-02 (-0.07*)	1.17E-03 (0.10**)	4.45E-01 (-0.02)	2.30E-01 (0.03)	2.05E-05 (0.13**)	1.89E-11 (0.38**)	1.20E-04 (0.16**)	2.15E-09 (0.24**)
	Axial Length	7.53E-01 (-0.00)	1.64E-01 (-0.03)	1.13E-02 (0.04*)	1.10E-05 (0.08**)	1.30E-01 (0.02)	1.74E-03 (0.06**)	3.09E-11 (0.22**)	3.85E-15 (0.19**)	9.23E-08 (0.13**)
	IOP	8.29E-02 (0.01)	1.36E-01 (0.01)	1.63E-01 (-0.01)	7.00E-01 (0.00)	9.99E-01 (-0.00)	4.40E-01 (-0.00)	6.44E-03 (-0.03**)	5.80E-02 (-0.02)	2.06E-03 (-0.02**)
	Height	2.52E-01 (-0.00)	1.05E-01 (0.00)	1.37E-04 (-0.01**)	8.01E-01 (0.00)	3.94E-02 (-0.00*)	2.56E-03 (-0.01**)	1.43E-09 (-0.02**)	3.50E-05 (-0.01**)	2.30E-10 (-0.02**)
	Weight	2.94E-01 (0.00)	9.72E-02 (0.00)	1.93E-01 (-0.00)	1.75E-01 (0.00)	5.72E-01 (0.00)	6.57E-03 (-0.00**)	6.49E-10 (-0.02**)	7.58E-06 (-0.01**)	5.19E-08 (-0.01**)
	BMI	3.65E-02 (0.01*)	3.92E-01 (0.00)	3.16E-01 (0.00)	2.44E-01 (0.00)	5.67E-02 (0.01)	2.47E-01 (-0.00)	2.99E-03 (-0.02**)	1.00E-02 (-0.01*)	2.79E-02 (-0.01*)
	Waist circumference	3.58E-01 (0.00)	8.08E-02 (0.00)	2.67E-01 (0.00)	1.76E-01 (0.00)	1.53E-02 (0.00*)	5.88E-01 (-0.00)	8.08E-04 (-0.01**)	3.04E-02 (-0.00*)	1.06E-01 (-0.00)
	Hip circumference	1.44E-02 (0.00*)	7.07E-02 (0.00)	1.76E-01 (0.00)	5.48E-01 (0.00)	9.00E-02 (0.00)	8.77E-01 (-0.00)	1.05E-02 (-0.01*)	2.30E-02 (-0.01*)	6.18E-02 (-0.01)
	SBP	3.76E-01 (0.00)	2.43E-01 (0.00)	2.93E-03 (0.00**)	3.41E-01 (0.00)	4.52E-02 (0.00*)	2.39E-01 (0.00)	3.03E-01 (0.00)	3.06E-01 (0.00)	6.66E-03 (0.00**)
	DBP	7.38E-04 (0.00**)	2.20E-04 (0.00**)	6.99E-01 (0.00)	7.47E-01 (0.00)	2.28E-01 (0.00)	5.09E-01 (-0.00)	8.18E-04 (-0.01**)	1.41E-04 (-0.01**)	1.43E-03 (-0.01**)
	Hypertension	1.97E-01 (-0.03)	2.38E-01 (-0.04)	2.20E-01 (0.04)	3.61E-01 (0.03)	2.03E-01 (0.04)	3.21E-01 (-0.03)	8.50E-01 (0.01)	1.30E-01 (0.06)	2.07E-02 (0.09*)
	Glucose	3.37E-07 (-0.05**)	5.68E-05 (-0.05**)	5.15E-03 (-0.03**)	6.54E-05 (-0.05**)	2.92E-04 (-0.04**)	6.74E-02 (-0.02)	8.82E-01 (-0.00)	5.96E-01 (-0.01)	8.09E-01 (-0.00)
	Diabetes	2.71E-05 (-0.14**)	7.31E-04 (-0.15**)	8.82E-02 (-0.07)	2.21E-03 (-0.13**)	1.42E-03 (-0.13**)	3.45E-02 (-0.10*)	7.72E-01 (-0.02)	9.24E-01 (-0.01)	4.85E-01 (0.04)
	Cholesterol	6.28E-02 (0.03)	3.09E-01 (-0.02)	7.84E-01 (-0.00)	1.42E-02 (-0.04*)	3.19E-03 (-0.05**)	4.76E-01 (-0.01)	6.78E-01 (0.01)	2.77E-01 (-0.03)	3.98E-01 (-0.02)
	HDL	2.69E-01 (0.04)	4.72E-01 (0.03)	8.91E-01 (0.01)	1.42E-01 (-0.06)	3.26E-01 (-0.04)	1.15E-01 (0.07)	3.72E-01 (0.07)	9.04E-01 (-0.01)	9.49E-01 (-0.00)
	LDL	9.72E-02 (0.03)	8.15E-01 (-0.00)	6.70E-01 (0.01)	3.73E-02 (-0.04*)	1.23E-02 (-0.05*)	7.76E-01 (-0.01)	8.95E-01 (0.00)	2.73E-01 (-0.03)	2.54E-01 (-0.03)
	TG	7.51E-01 (0.00)	6.64E-02 (-0.03)	2.24E-01 (-0.02)	5.94E-01 (-0.01)	6.62E-01 (-0.01)	3.44E-02 (-0.03*)	6.07E-01 (-0.01)	2.23E-01 (-0.02)	8.00E-01 (-0.00)
POS	Age	4.49E-84 (-0.16**)	3.41E-75 (-0.15**)	6.11E-81 (-0.17**)	9.86E-87 (-0.16**)	5.02E-99 (-0.17**)	7.02E-82 (-0.17**)	1.25E-73 (-0.18**)	5.27E-87 (-0.17**)	1.21E-102 (-0.20**)
	Gender	1.70E-02 (0.36*)	7.10E-03 (-0.40**)	7.45E-05 (-0.61**)	2.83E-02 (-0.31*)	1.25E-03 (-0.48**)	2.28E-11 (-1.04**)	4.57E-11 (-1.14**)	5.03E-09 (-0.89**)	3.89E-11 (-1.08**)
	Axial Length	6.61E-07 (-0.44**)	1.26E-09 (-0.52**)	2.01E-08 (-0.50**)	4.97E-07 (-0.42**)	1.06E-06 (-0.42**)	1.20E-08 (-0.52**)	1.54E-08 (-0.57**)	1.13E-06 (-0.44**)	1.21E-04 (-0.37**)
	IOP	6.73E-03 (0.08**)	9.95E-03 (0.07**)	1.57E-03 (0.10**)	2.90E-03 (0.08**)	2.53E-03 (0.09**)	6.19E-04 (0.11**)	1.18E-03 (0.11**)	1.60E-03 (0.09**)	2.57E-04 (0.12**)
	Height	7.03E-02 (0.02)	3.19E-06 (0.04**)	1.14E-09 (0.06**)	6.79E-07 (0.04**)	4.33E-09 (0.05**)	3.70E-14 (0.08**)	3.62E-14 (0.08**)	8.07E-15 (0.08**)	6.58E-17 (0.09**)
	Weight	7.58E-01 (0.00)	3.42E-02 (0.01*)	4.20E-05 (0.03**)	3.00E-03 (0.02**)	1.92E-04 (0.02**)	1.78E-06 (0.03**)	4.72E-09 (0.04**)	1.31E-09 (0.04**)	5.26E-10 (0.04**)
	BMI	3.90E-01 (-0.02)	5.41E-01 (-0.01)	5.32E-01 (0.01)	9.23E-01 (0.00)	6.68E-01 (0.01)	6.13E-01 (0.01)	1.08E-01 (0.04)	6.75E-02 (0.04)	9.32E-02 (0.04)
	Waist circumference	6.31E-05 (-0.03**)	2.41E-02 (-0.02*)	4.96E-01 (-0.01)	5.57E-02 (-0.01)	2.22E-01 (-0.01)	9.28E-01 (0.00)	1.70E-01 (0.01)	3.33E-01 (0.01)	2.39E-01 (0.01)
	Hip circumference	9.89E-01 (0.00)	9.14E-01 (-0.00)	3.03E-01 (0.01)	8.38E-01 (0.00)	4.10E-01 (0.01)	4.58E-01 (0.01)	4.67E-02 (0.02*)	2.97E-02 (0.02*)	3.41E-02 (0.02*)

POS	SBP	1.52E-07 (-0.02**)	2.53E-05 (-0.02**)	1.54E-04 (-0.01**)	1.40E-05 (-0.02**)	2.23E-06 (-0.02**)	2.57E-03 (-0.01**)	5.60E-03 (-0.01**)	5.21E-03 (-0.01**)	1.63E-03 (-0.01**)
	DBP	1.32E-02 (0.02*)	1.07E-04 (0.02**)	3.51E-06 (0.03**)	1.33E-05 (0.02**)	1.63E-05 (0.03**)	1.58E-07 (0.03**)	4.40E-07 (0.04**)	2.03E-09 (0.04**)	5.78E-09 (0.04**)
	Hypertension	1.40E-05 (-0.64**)	1.20E-05 (-0.64**)	4.61E-05 (-0.62**)	1.70E-05 (-0.60**)	2.14E-06 (-0.69**)	1.60E-04 (-0.59**)	6.31E-04 (-0.59**)	1.40E-04 (-0.58**)	3.38E-05 (-0.67**)
	Glucose	4.00E-03 (-0.17**)	5.45E-02 (-0.11)	1.70E-02 (-0.14*)	3.61E-03 (-0.16**)	5.34E-03 (-0.16**)	1.87E-01 (-0.08)	1.07E-01 (-0.11)	6.34E-03 (-0.16**)	9.20E-03 (-0.17**)
	Diabetes	9.77E-05 (-0.85**)	7.07E-04 (-0.73**)	2.77E-03 (-0.68**)	5.06E-05 (-0.84**)	5.70E-06 (-0.98**)	3.79E-03 (-0.67**)	1.68E-02 (-0.61*)	8.06E-05 (-0.88**)	1.58E-06 (-1.15**)
	Cholesterol	6.04E-04 (0.30**)	9.51E-02 (0.14)	5.28E-01 (0.06)	7.90E-02 (0.14)	1.48E-01 (0.12)	9.00E-01 (0.01)	9.45E-01 (-0.01)	8.04E-01 (0.02)	9.87E-01 (0.00)
	HDL	1.08E-02 (0.54*)	2.95E-02 (0.45*)	7.99E-02 (0.38)	4.23E-02 (0.41*)	6.42E-02 (0.39)	2.16E-01 (0.27)	2.55E-01 (0.28)	2.68E-01 (0.24)	8.24E-02 (0.40)
	LDL	1.10E-03 (0.31**)	6.55E-02 (0.17)	2.82E-01 (0.11)	3.96E-02 (0.19*)	6.77E-02 (0.17)	6.58E-01 (0.04)	6.12E-01 (0.06)	3.48E-01 (0.09)	6.07E-01 (0.05)
	TG	6.41E-01 (-0.03)	2.30E-01 (-0.08)	1.32E-01 (-0.10)	3.21E-01 (-0.06)	2.16E-01 (-0.08)	2.51E-01 (-0.08)	1.93E-01 (-0.10)	1.88E-01 (-0.09)	1.03E-01 (-0.12)
RPE/BM	Age	1.90E-115 (0.09**)	5.24E-74 (0.08**)	1.87E-79 (0.08**)	4.12E-102 (0.09**)	2.11E-91 (0.08**)	4.33E-58 (0.06**)	4.85E-62 (0.05**)	6.62E-88 (0.07**)	3.77E-83 (0.07**)
	Gender	6.63E-02 (-0.13)	1.65E-01 (0.11)	1.04E-01 (0.12)	5.23E-01 (-0.05)	8.54E-01 (-0.01)	1.55E-02 (0.16*)	4.38E-02 (0.11*)	1.26E-01 (0.10)	6.57E-02 (0.12)
	Axial Length	4.16E-10 (0.27**)	7.66E-14 (0.35**)	8.32E-11 (0.28**)	5.13E-10 (0.27**)	5.35E-12 (0.29**)	6.29E-16 (0.32**)	4.26E-13 (0.23**)	1.79E-09 (0.23**)	6.55E-08 (0.20**)
	IOP	4.60E-02 (-0.03*)	2.06E-02 (-0.04*)	3.45E-02 (-0.03*)	4.95E-02 (-0.03*)	4.11E-02 (-0.03*)	1.32E-02 (-0.03*)	3.19E-02 (-0.02*)	9.02E-02 (-0.02)	1.84E-02 (-0.03*)
	Height	8.95E-02 (-0.01)	1.78E-03 (-0.02**)	2.04E-04 (-0.02**)	1.27E-02 (-0.01*)	1.66E-02 (-0.01*)	2.62E-04 (-0.02**)	1.53E-04 (-0.01**)	2.81E-05 (-0.02**)	3.38E-05 (-0.02**)
	Weight	1.27E-03 (-0.01**)	4.77E-04 (-0.01**)	1.32E-07 (-0.02**)	1.65E-06 (-0.02**)	5.25E-06 (-0.01**)	6.67E-05 (-0.01**)	1.67E-08 (-0.01**)	1.07E-11 (-0.02**)	6.94E-11 (-0.02**)
	BMI	7.54E-03 (-0.03**)	3.67E-02 (-0.02*)	2.78E-04 (-0.03**)	1.02E-04 (-0.04**)	1.57E-04 (-0.04**)	2.28E-02 (-0.02*)	7.85E-05 (-0.03**)	4.19E-07 (-0.04**)	8.86E-07 (-0.04**)
	Waist circumference	5.34E-01 (-0.00)	1.81E-01 (-0.01)	1.19E-02 (-0.01*)	3.92E-02 (-0.01*)	1.01E-02 (-0.01*)	6.59E-02 (-0.01)	7.75E-04 (-0.01**)	3.16E-05 (-0.01**)	1.51E-05 (-0.01**)
	Hip circumference	3.65E-04 (-0.02**)	2.30E-03 (-0.02**)	2.50E-05 (-0.02**)	7.62E-05 (-0.02**)	4.86E-05 (-0.02**)	9.64E-03 (-0.01**)	7.43E-06 (-0.02**)	2.53E-08 (-0.02**)	2.12E-07 (-0.02**)
	SBP	3.27E-02 (0.00*)	1.54E-01 (0.00)	1.21E-01 (0.00)	7.08E-02 (0.00)	1.56E-01 (0.00)	1.03E-01 (0.00)	2.05E-01 (0.00)	6.15E-01 (0.00)	5.97E-01 (0.00)
	DBP	6.50E-08 (-0.02**)	2.06E-08 (-0.02**)	2.08E-08 (-0.02**)	9.57E-09 (-0.02**)	1.43E-08 (-0.02**)	1.06E-06 (-0.01**)	4.19E-08 (-0.01**)	1.17E-12 (-0.02**)	2.26E-10 (-0.02**)
	Hypertension	5.91E-05 (0.29**)	1.59E-03 (0.25**)	4.04E-03 (0.21**)	1.36E-03 (0.24**)	1.21E-03 (0.23**)	2.41E-02 (0.15*)	2.44E-02 (0.12*)	3.85E-02 (0.13*)	1.29E-02 (0.16*)
	Glucose	3.58E-02 (0.06*)	1.52E-01 (0.04)	8.92E-03 (0.07**)	1.81E-03 (0.09**)	6.06E-03 (0.08**)	3.41E-01 (0.03)	2.98E-02 (0.05*)	1.14E-03 (0.08**)	1.36E-02 (0.06*)
	Diabetes	3.80E-05 (0.44**)	1.76E-03 (0.37**)	2.99E-03 (0.32**)	6.38E-06 (0.50**)	8.66E-07 (0.52**)	2.23E-03 (0.30**)	2.33E-03 (0.25**)	1.10E-06 (0.46**)	1.05E-07 (0.50**)
	Cholesterol	2.15E-01 (-0.05)	8.70E-01 (-0.01)	7.93E-01 (0.01)	5.00E-01 (-0.03)	8.84E-01 (0.01)	6.57E-01 (0.02)	5.32E-01 (0.02)	4.82E-01 (0.03)	3.55E-01 (0.04)
	HDL	4.45E-01 (-0.08)	4.84E-01 (-0.08)	6.39E-01 (-0.05)	8.94E-01 (-0.01)	5.62E-01 (-0.06)	9.91E-01 (-0.00)	7.84E-01 (-0.02)	9.26E-01 (0.01)	4.73E-01 (-0.07)
	LDL	1.56E-01 (-0.07)	5.29E-01 (-0.03)	7.04E-01 (-0.02)	2.35E-01 (-0.06)	6.76E-01 (-0.02)	8.09E-01 (-0.01)	9.52E-01 (-0.00)	8.91E-01 (-0.01)	7.22E-01 (0.01)
	TG	2.59E-01 (-0.04)	8.16E-01 (-0.01)	9.80E-01 (-0.00)	2.81E-01 (-0.04)	8.67E-01 (-0.01)	9.88E-01 (0.00)	8.43E-01 (-0.01)	9.05E-01 (-0.00)	6.73E-01 (0.01)

Data are presented as P-value (Correlation coefficient)
*significant at the 0.05 level (2-tailed); **significant at the 0.01 level (2-tailed).
IOP: intraocular pressure; BMI: body mass index; SBP: systolic blood pressure; DBP: diastolic blood pressure; HDL: high density lipoprotein; LDL: low density lipoprotein; TG: triglyceride