

AN EXPLORATORY STUDY OF OPTIC NERVE HEAD VASCULAR FRACTAL DIMENSION (DF) AND ITS ASSOCIATION WITH DIABETES MELLITUS RISK FACTORS

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ABSTRACT

Background: Undiagnosed diabetes mellitus (DM) in the world's population is expected to increase. Screening for individuals with risk of developing DM may help early detection to prevent diabetic retinopathy. Smartphone-assisted fundus photography (SAFP) may be a valuable screening tool to detect early retinal DM-related changes. Digital retinal images captured by SAFP has been shown as reliable in evaluating retinal vascular complexity using fractal dimension (Df) analysis. This exploratory, cross-sectional study was conducted to compare the optic nerve head (ONH) vascular Df between individuals with and without DM-risks using images taken by SAFP.

Methodology: Ninety participants comprising of 45 individuals with and without risk of DM were recruited. The Diabetes Risk Test Questionnaires (DRTQ; American Diabetes Association (2018a)) was adopted to classify participants into the previously mentioned groups. Retinal images from one eye were taken from each participant using SAFP, which comprised a smartphone (Samsung SM-G925F, Samsung C&T Corp., Seoul, Republic of Korea) and the Portable Eye Examination Kit Retina camera adaptor (Peek Retina™, Peek Vision Ltd, UK). Images with a good focus centred on ONH and significant blood vessel visibility were taken for fractal dimension (Df) analysis. Images were cropped 0.5 disc diameters away from disc margin and resized to 500x500 pixels using GNU Image Manipulation Program Version 2.8.18 (GIMP, The GIMP Team, United States). Retinal vessels were manually traced for blood vessel segmentation using the layering capabilities of GIMP. Df values of segmented blood vessels were measured using Image J (National Institutes of Health, USA) and its plugin software, FraCLac Version 2.5. Independent t-test and ANCOVA were used to compare the retinal vascular Df values between the risked- and non-risked groups and explore the association between DM risk factors and Df values.

Results: There was no significant difference in ONH vascular Df values between risked- and non-risked DM groups. No association between the ONH vascular Df and DM risk factors were detected.

Conclusion: Retinal vascular complexity between individuals with and without risk factors of DM showed no difference. The ONH retinal vascular complexity between individuals with and without risk factors of DM showed no difference. DM risk factors did not influence ONH vasculatures and may suggest for investigation on other retinal loci.

Keywords: smartphone-assisted fundus photography, fractal dimension analysis, Diabetes Risk Test Questionnaires