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Functional Medicine

QUOTE GM #40

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Title

Created

GUT-RETINA AXIS: HOW TO PREVENT MACULAR DEGENERATION!

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Involvement of a gut-retina axis in protection against dietary glycemia-induced age-related macular degeneration.

Rowan S¹, Jiang S¹, Korem T^{2,3}, Szymanski J⁴, Chang M¹, Szelog J¹, Cassalman C⁵, Dasuri K¹, McGuire C⁶, Nagai R⁷, Du XL⁸, Brownlee M⁸, Rabbani N⁹, Thornalley PJ⁹, Baleja JD⁶, Deik AA¹⁰, Pierce KA¹⁰, Scott JM¹⁰, Clish CB¹⁰, Smith DE¹, Weinberger A^{2,3}, Avnit-Sagi T^{2,3}, Lotan-Pompan M^{2,3}, Segal E^{2,3}, Taylor A¹¹.

Author information

Abstract

Age-related macular degeneration (AMD) is the major cause of blindness in developed nations. AMD is characterized by retinal pigmented epithelial (RPE) cell dysfunction and loss of photoreceptor cells. Epidemiologic studies indicate important contributions of dietary patterns to the risk for AMD, but the mechanisms relating diet to disease remain unclear. Here we investigate the effect on AMD of isocaloric diets that differ only in the type of dietary carbohydrate in a wild-type aged-mouse model. The consumption of a high-glycemia (HG) diet resulted in many AMD features (AMDf), including RPE hypopigmentation and atrophy, lipofuscin accumulation, and photoreceptor degeneration, whereas consumption of the lower-glycemia (LG) diet did not. Critically, switching from the HG to the LG diet late in life arrested or reversed AMDf. LG diets limited the accumulation of advanced glycation end products, long-chain polyunsaturated lipids, and their peroxidation end-products and increased C3-carnitine in retina, plasma, or urine. Untargeted metabolomics revealed microbial cometabolites, particularly serotonin, as protective against AMDf. Gut microbiota were responsive to diet, and we identified microbiota in the Clostridiales order as being associated with AMDf and the HG diet, whereas protection from AMDf was associated with the Bacteroidales order and the LG diet. Network analysis revealed a nexus of metabolites and microbiota that appear to act within a gut-retina axis to protect against diet- and age-induced AMDf. The findings indicate a functional interaction between dietary carbohydrates, the metabolome, including microbial cometabolites, and AMDf. Our studies suggest a simple dietary intervention that may be useful in patients to arrest AMD.

KEYWORDS: advanced glycation end-product; age-related macular degeneration; glycemic index; gut microbiome; metabolomics

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