Issue 48 2016

PRIMARY eyecare

Food, Fats, Weight, Eyes

2 weekly servings of oily fish is associated with a decreased risk of sight-threatening DR

Results published in JAMA Ophthalmology August 2016 show that intake of at least 500 mg/d of dietary LCω3PUFA, easily achievable with 2 weekly servings of oily fish, is associated with a decreased risk of sight-threatening DR.

Data was obtained from participants in the randomized clinical trial Prevención con Dieta Mediterránea (PREDIMED), which tested Mediterranean diets supplemented with extra virgin olive oil or nuts vs a control diet for primary cardiovascular prevention. The trial was conducted in primary health care centres in Spain. From 2003 to 2009, 3614 individuals aged 55 to 80 years with a previous diagnosis of type 2 diabetes were recruited. Full data were available for 3482 participants (48% men; mean age 67 years).

The Mediteranean diet rich in olive oil is a strong source of omega3 fatty acids. The PREDIMED researchers noted that the retina is rich in long-chain omega3 polyunsaturated fatty acids (LCω3PUFAs), which are substrate for oxylipins with anti-inflammatory and antiangiogenic properties. Experimental models support dietary LCω3PUFA protection against DR, but clinical data are lacking. The PREDIMED data provided an opportunity to determine whether LCω3PUFA intake relates to a decreased incidence of sight-threatening DR in individuals with type 2 diabetes older than 55 years.

Dr Sala-Vila and colleagues looked at whether participants met the dietary LCω3PUFA recommendation of at least 500 mg/d for primary cardiovascular prevention, as assessed by a validated food-frequency questionnaire against the incidence of DR requiring laser photocoagulation, vitrectomy, and/or antiangiogenic therapy confirmed by an external adjudication committee.

A total of 2611 participants (75%) met target LCω3PUFA recommendation. During a median follow-up of 6 years, there were 69 documented new events. After adjusting for age, sex, intervention group, and lifestyle and clinical variables, participants meeting the LCω3PUFA recommendation at baseline (≥500 mg/d) compared with those not fulfilling this recommendation (<500 mg/d) showed a 48% relatively reduced risk of incident sight-threatening DR, with a hazard ratio of 0.52 (95% CI, 0.31-0.88; P = .001).

The researchers concluded that in middle-aged and older individuals with type 2 diabetes, intake of at least 500 mg/d of dietary LCω3PUFA, easily achievable with 2 weekly servings of oily fish, is associated with a decreased risk of sight-threatening DR. The results concur with findings from experimental models and the current model of DR pathogenesis.

500 mg/d of dietary LCω3PUFA showed a decreased risk of sight-threatening DR.

Source:
Dietary Marine ω-3 Fatty Acids and Incident Sight-Threatening Retinopathy in Middle-Aged and Older Individuals With Type 2 Diabetes: Prospective Investigation From the PREDIMED Trial ONLINE FIRST. Sala-Vila,et al., 2016

Structures of Omega-3 Fatty Acids

The omega-3 fatty acids are long-chain polyunsaturated fatty acids ranging from 18 to 22 carbon atoms in chain length with the first of many double bonds beginning at the third carbon (upon counting from the methyl end of the fatty acid structure). The fish/fish oil-based omega-3 polyunsaturated fatty acids (also referred to as n-3 fatty acids or n -3 polyunsaturates) consist of DHA, docosahexaenoic acid (22 carbon atoms, 6 double bonds) and EPA, eicosapentaenoic acid (20 carbon atoms, 5 double bonds).

Source:
Omega-3 fatty acids in cardiovascular care. Holub, 2002.

Dietary sources of LCω3PUFA

Long Chain Omega3 Polyunsaturated Fatty Acids are found mainly in seafood, with salmon, trout and herring being particularly rich sources providing around 2.0g per 100g. White fish contains 0.1-0.4g, while shellfish provide 0.2-1.4g per 100g

Source:
The benefits of fish consumption. Ruxton, 2011

Obesity, AMD, and Gut Bacteria

Neovascular AMD, also known as Wet AMD, is the world's leading cause of vision loss in the over 55 age group.

Here in New Zealand AMD in both wet and dry forms is recognised as the major cause of vision loss in New Zealanders over 50 and while only around 10% of those with AMD have the wet form it is the wet form which poses the most reliable threat of blindness.

The New Zealand National Health Committee 2015 consultation paper on Age-related Macular Degeneration estimated patient flows and annual costs for the public health system from this particular condition. It was estimated that hospital outpatient ophthalmology clinics were seeing between 9,000 and 18,000 people with Wet AMD with an annual cost of between $4m and $8m. Inpatient costs for treatment of 1500 people with Wet AMD accounted for a further annual cost of $4.5m.

While the availability of treatment using intravitreal injections of Lucentis or Avastin provides opportunity for many with neovascular AMD to arrest vision loss or even recover some lost vison, for others treatment is not successful or is not appropriate. This means preventing or slowing the development of AMD remains an important factor in public health.

It has long been recognised that there is a strong genetic component in the risk of a person developing any form of AMD and that smoking is the major modifiable risk factor. More recently, the Melbourne Collaborative Cohort Study, with 21,287 participants, demonstrated an association between abdominal fat and AMD progression among the male participants. Each increase of 0.1 in waist/hip ratio (a measure for abdominal obesity) was associated with a 13% increase in the odds of early AMD and a 75% increase in the odds of late AMD in men, making obesity the second most important environmental risk factor for late AMD after cigarette smoking.

Even though the mechanisms that underscore this association between abdominal fat and AMD progression are not well understood the findings add to the growing understanding that progression of AMD is likely to be more complex than previously thought. Support for the idea of environmental factors predisposing to AMD is supported by the fact that genetically unrelated individuals with shared long-term environmental exposure develop the disease with a high level of concordance.

AMD is characterized by persistent low-grade inflammation a heightened immune response, sizeable deposits of fat debris at the back of the eye called soft drusen (early AMD), destruction of nerve cells, and growth of new diseased blood vessels (wet AMD, late form). Shared microbial exposure is a potential consequence of cohabitation and common lifestyle behaviours within a shared environment may prospectively impact disease modifiers such as systemic inflammation. More research is needed to tease out the contribution of environmental factors that may act in combination.

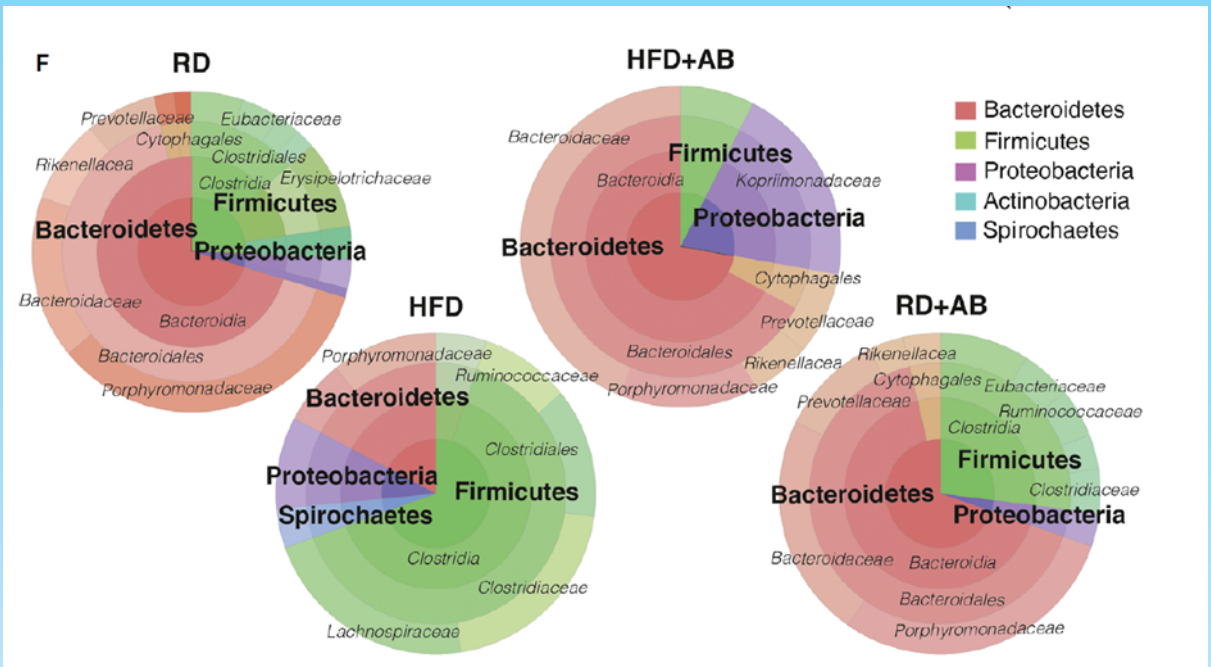
In a November 2016 report in EMBO Molecular Medicine, Elisabeth Andriessen and colleagues note that as gut microbiota exert profound influence on digestion, dietary metabolism, endotoxemia, and immune responses they are prime candidates to impact chronic low-grade inflammation. They also noted that high-fat diets have an impact on gut microbiota and contribute to weight gain. This led them to investigate whether commensal microbes influence the evolution of AMD.

Using mouse models of Neovascular (NV) AMD, diet modification, and treatment with anti-biotics to influence the gut microbiome, the researchers uncoupled weight gain from confounding factors and demonstrated that high-fat diets exacerbate choroidal neovascularization (CNV) by altering gut microbiota.

The mice were assigned to a Regular Diet (RD) or High Fat Diet (HFD) group at 6 weeks. At 11 weeks half of each group was administered neomycin in the drinking water (RD+AB, HFD+AB). At 11 weeks all mice were subjected to a laser-induced photocoagulation model of CNV, where perforation of Bruch's membrane initiates sprouting of subretinal blood vessels from the choroid, thus mimicking NV AMD.

Imaging 14 days after laser burn revealed a robust 60% increase in CNV in HFD-fed mice when compared to RD controls. However, HFD-fed mice treated with neomycin displayed levels of CNV akin to RD-fed control mice but the neomycin treatment did not affect weight gain. This pointed to a specific effect related to gut microbial profile.

The report published the following diagram showing the gut microbiota analysed from the four groups.



Andriessen et al concluded that changes in the bacterial communities of the gut, such as those brought on by a diet rich in fat, can cause long-term low-grade inflammation throughout the body and eventually promote diseases such as wet AMD.

Source:
Gut microbiota influences pathological angiogenesis in obesity driven choroidal neovascularization. Andriessen, et al., 2016.

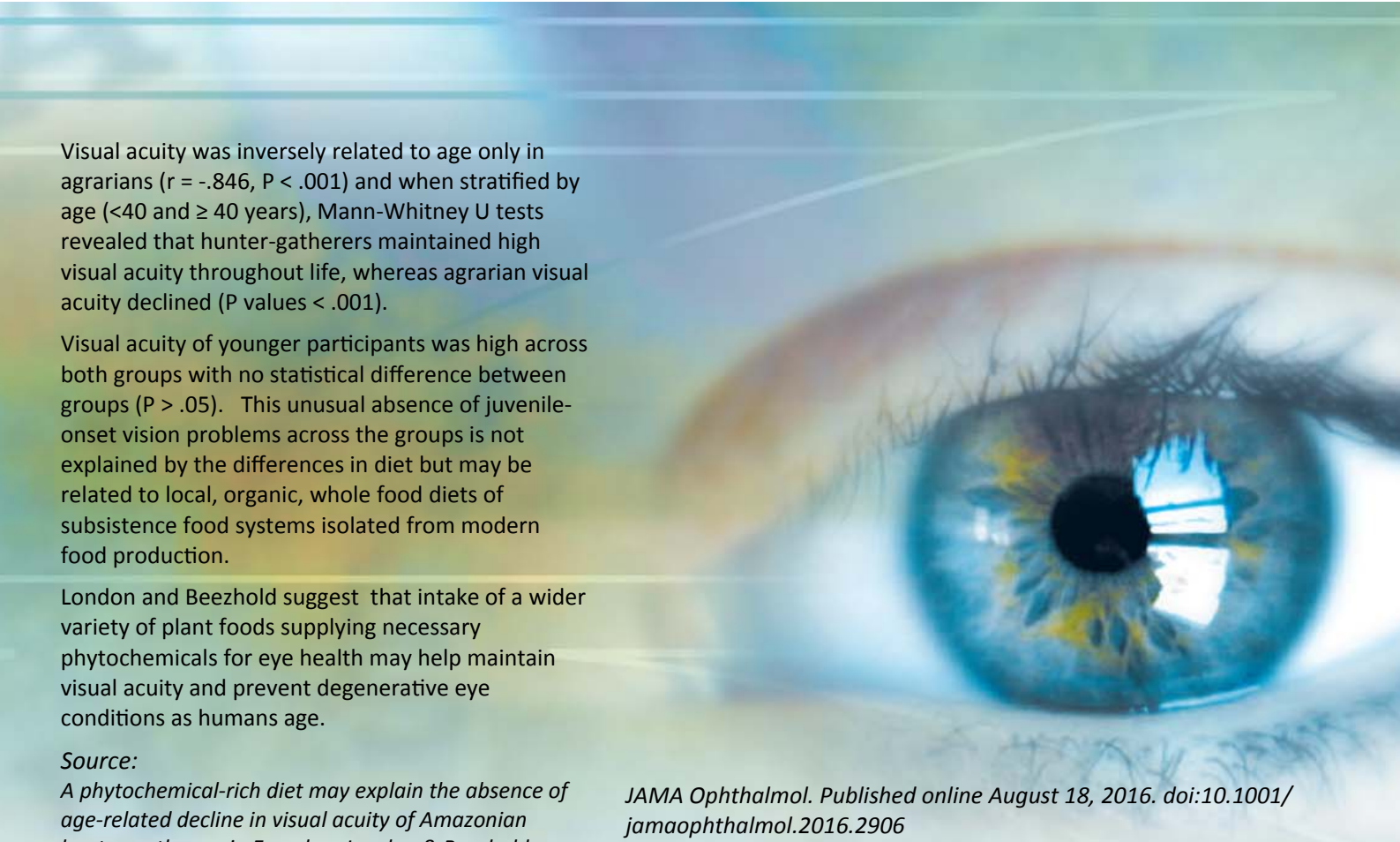
Can diet affect visual acuity?

The link between dietary phytochemicals and eye health is well established. There have been many studies showing an association between foods, diet, and dietary supplements in western populations and the development and progression of AMD but diet has been little studied in respect of myopia or visual acuity.

Much recent research on myopia has looked at the potential effects of natural light and comparisons have been made between rural and urban populations in respect of the incidence of myopia but the study by London and Beezhold (2015) may be a first. Published in the journal Nutritional Research in February 2015, the study investigated the proposition that a phytochemical-rich diet may explain the absence of age-related decline in visual acuity of Amazonian hunter-gatherers in Ecuador.

London and Beezhold note that myopia is absent in undisturbed hunter-gatherers but ubiquitous in modern populations. They also point to the link between dietary phytochemicals and eye health but note the transition away from a wild diet has reduced phytochemical variety. They hypothesized that when larger quantities and greater variety of wild, seasonal phytochemicals are consumed in a food system, there will be a reduced prevalence of degenerative-based eye disease as measured by visual acuity.

Their study compared food systems and visual acuity across isolated Amazonian Kawymeno Waorani hunter-gatherers and neighbouring Kichwa subsistence agrarians, using dietary surveys, dietary pattern observation, and Snellen Illiterate E visual acuity examinations. Results showed that hunter-gatherers consumed more food species (130 vs. 63) than their agrarian neighbours and ate more wild plants (80 vs. 4) including 76 wild fruits. The hunter-gatherer diet contained a larger variety and greater quantity of phytochemicals than that of the agrarians.



Visual acuity was inversely related to age only in agrarians ($r = -.846$, $P < .001$) and when stratified by age (<40 and ≥ 40 years), Mann-Whitney U tests revealed that hunter-gatherers maintained high visual acuity throughout life, whereas agrarian visual acuity declined (P values < .001).

Visual acuity of younger participants was high across both groups with no statistical difference between groups ($P > .05$). This unusual absence of juvenile-onset vision problems across the groups is not explained by the differences in diet but may be related to local, organic, whole food diets of subsistence food systems isolated from modern food production.

London and Beezhold suggest that intake of a wider variety of plant foods supplying necessary phytochemicals for eye health may help maintain visual acuity and prevent degenerative eye conditions as humans age.

Source:
A phytochemical-rich diet may explain the absence of age-related decline in visual acuity of Amazonian hunter-gatherers in Ecuador. London & Beezhold, 2015.

Bibliography:

Dietary Marine ω-3 Fatty Acids and Incident Sight-Threatening Retinopathy in Middle-Aged and Older Individuals With Type 2 DiabetesProspective Investigation From the PREDIMED Trial ONLINE FIRST Aleix Sala-Vila, Andrés Díaz-López, Cinta Valls-Pedret, Montserrat Cofán, Alfredo García-Layana, Rosa-María Lamuela-Raventós, Olga Castañer, Vicente Zanon-Moreno, Miguel A. Martinez-Gonzalez, Estefanía Toledo, Josep Basora, Jordi Salas -Salvadó, Dolores Corella, Enrique Gómez-Gracia, Miquel Fiol, Ramón Estruch, José Lapetra, Montserrat Fitó, Fernando Arós, Luis Serra-Majem, Xavier Pintó, Emilio Ros ; for the Prevención con Dieta Mediterránea (PREDIMED) Investigators. JAMA Ophthalmol. Published online August 18, 2016. doi:10.1001/jamaophthalmol.2016.2906

Holub, B.J. Clinical nutrition: 4. Omega-3 fatty acids in cardiovascular care. CMAJ. 166: 608-615, 2002.

http://www.dhaomega3.org/Overview/Structures-of-Omega-3-Fatty-Acids

Ruxton CHS (2011a). The benefits of fish consumption. Nutrition Bulletin 36, 6-19.

Gut microbiota influences pathological angiogenesis in obesity driven choroidal neovascularization. Elisabeth MMA Andriessen, Ariel M Wilson, Gaelle Mawambo, Agnieszka Dejda, Khalil Miloudi, Florian Sennlaub, Przemyslaw Sapieha. 201.6 EMBO Molecular Medicine (2016) e201606531. Published online: DOI 10.15252/emmm.201606531 | Published online 15.11.2016

A phytochemical-rich diet may explain the absence of age-related decline in visual acuity of Amazonian hunter-gatherers in Ecuador. London DS, Beezhold B. Nutr Res. 2015 Feb;35(2):107-17. doi: 10.1016/j.nutres.2014.12.007. Epub 2014 Dec 31.

PRIMARY EYE CARE

New Zealand Permit No. 158959 Permit

«Title» «Surname»
«Address line 1»
«Address line 2»
«Address line 3»
«Address line 4»
«Add5»

NZ Association of Optometrists
PO Box 1978
WELLINGTON