THE IMPACT OF DIET ON GLAUCOMA RISK


Simple recommendations on nutrition could make a significant difference in patients' health.

BY JEFFREY SOOHOO, MD, MBA, AND MONICA ERTEL, MD, PHD

ASSOCIATION OF DIETARY NITRATE INTAKE WITH PRIMARY OPEN-ANGLE GLAUCOMA: A PROSPECTIVE ANALYSIS FROM THE NURSES' HEALTH STUDY AND HEALTH PROFESSIONALS FOLLOW-UP STUDY

Kang JH, Willett WC, Rosner BA, Buys E, Wiggs JL, Pasquale LR[1]

Industry support for this study: None

ABSTRACT SUMMARY

A 25-year prospective analysis of more than 100,000 patients evaluated the association between dietary nitrate intake and primary open-angle glaucoma (POAG). Participants included 63,893 women from the Nurses' Health Study (NHS) and 41,094 men from the Health Professionals Follow-up Study (HPFS). All patients were older than 40 years of age, did not have glaucoma at the start of the NHS or HPFS, and received regular eye examinations.

Every 2 years, participants completed a survey on their health, diet, and disease. Information about dietary nitrate consumption was obtained with a validated food questionnaire that inquired about their average intake of a food or beverage during the preceding years. There was a focus on participants' daily intake of green leafy vegetables, cruciferous vegetables, root vegetables, and tomato-based foods, which are high in nitrate content. The nitrate content of these foods was then used to generate a cumulative average intake of nitrates. Patients were divided into quintiles based on the amount of dietary nitrate they consumed.

During the study period, 1,483 new POAG cases were identified. All diagnoses were confirmed with medical record reviews by a glaucoma specialist. Confirmation of a POAG diagnosis entailed the following:

- A slit-lamp examination that excluded other etiologies causing secondary glaucoma;
- Reproducible defects on two subsequent and reliable visual field tests; and
- Either gonioscopy without angle occlusion or documentation of pupillary dilation without adverse events.

Patients were divided into subtypes based on IOP (normal- vs high-tension glaucoma) and the pattern of visual field loss (paracentral defects vs peripheral visual field loss).

Compared to other study participants, patients in the highest quintile of dietary nitrates and green leafy vegetable intake had a 20% to 30% lower risk of POAG and a 40% to 50% lower risk of paracentral visual field loss. In addition, more than one serving per month of kale or collard greens was associated with a 55% to 70% reduction in POAG risk.

DISCUSSION

Patients frequently ask, "What is the best diet for glaucoma?" The study by Kang and colleagues showed that a simple dietary modification can have a meaningful impact on patients' risk of developing POAG.[1] Increasing dietary nitrate through the consumption of green leafy vegetables is a straightforward lifestyle intervention for physicians to recommend.

Dietary nitrates from vegetables are a precursor to nitric oxide (NO), which benefits circulation. The effect of NO on aqueous humor dynamics helps reduce IOP, whereas the inhibition of NO, which is found in several tissues in the anterior chamber, has been found to elevate IOP.[2] Additionally, NO has known effects on smooth muscles in blood vessels, potentially improving ocular blood flow. The reduced frequency of paracentral visual field defects observed by Kang and colleagues might be related to the association

STUDY IN BRIEF

- A 25-year prospective analysis evaluated the association between dietary nitrate intake and primary open-angle glaucoma in a large population of health care professionals. The study used a validated food questionnaire to determine participants' vegetable intake and used that information to divide patients into quintiles based on nitrate consumption. Participants in the highest quintile of nitrate consumption from vegetables were at significantly lower risk of developing primary open-angle glaucoma and paracentral visual field defects.

WHY IT MATTERS

The study provides straightforward guidance on a lifestyle modification patients can make to reduce their risk of developing glaucoma. Study participants in the highest quintile of nitrate intake consumed approximately five to six servings of nitrate-containing vegetables per day. These vegetables included green leafy vegetables, cruciferous vegetables, root vegetables, and tomato-based foods; of these, green leafy vegetables had the highest nitrate content. Recommending this diet to patients could meaningfully reduce their risk of developing glaucoma and visually significant visual field defects.

between these defects and decreased optic nerve perfusion.[1]

Not all dietary nitrates are the same. Naturally occurring nitrate in vegetables contains several nutrients and antioxidants that trigger the production of NO. In contrast, the form of nitrate used to preserve foods such as processed meats is not paired with antioxidants, and the compound is shuttled into a different pathway, resulting in the production of toxins that have been associated with an increased risk of cancer.[3]

GLAUCOMA AND DIETARY LINKS: INSIGHTS FROM HIGH-SALT INTAKE, THE MEDITERRANEAN DIET, AND SPECIFIC NUTRIENTS

Yang Y, Zhou H, Hong Z[4]

Industry support for this study: None

ABSTRACT SUMMARY

This review of relevant studies published during the past 20 years investigated the impact of the high-salt and Mediterranean diets on glaucoma as well as the association between certain nutrients and disease risk and progression.

The Mediterranean diet encourages the consumption of vegetables, fruits, whole grains, legumes, healthy fats in the form of nuts and olive oil, moderate amounts of fish and wine, and single-ingredient whole foods that are low in sugar. It recommends reducing the consumption of processed foods. The antiinflammatory health benefits of the Mediterranean diet are widely understood to result from the increased intake of antioxidants, vitamins, and polyphenolic compounds. This diet has been shown to be protective against the incidence of glaucoma.[5]

Systemically, a diet high in salt elevates serum sodium, which can reduce NO production. This, in turn, can lead to endothelial cell dysfunction and stiffening of the blood vessels, negatively affecting blood flow and increasing oxidative stress. The intake of high amounts of sodium can increase IOP through elevated plasma colloid osmolality, which affects the ultrafiltration process involved in aqueous production.[6] High urinary sodium excretion—a marker for dietary sodium intake—has been shown to increase the likelihood of developing glaucoma in patients with genetic risks for the disease.[7]

Multiple studies have suggested that an increased intake of omega-3 fatty acids may have a beneficial impact on glaucoma through antiinflammatory and antioxidant pathways and increased blood flow[8,9] The study by Yang and colleagues focused on vitamins A, E, C, B, K1, and D, which research has suggested may help reduce the prevalence of glaucoma or slow its progression.[4,10] Many of those studies, however, were in animal models, leading Yang et al to conclude that more research on the role of these vitamins in glaucoma is required to draw definitive conclusions about their benefit.

Notably, a high intake of calcium, selenium, zinc, and iron was associated with a potentially increased risk of developing glaucoma.[4]

STUDY IN BRIEF

- A review of studies published during the past 20 years investigated the effects of the high-salt diet and the Mediterranean diet on glaucoma as well the impact of certain nutrients on disease prevalence and progression. The Mediterranean diet was found to decrease the risk of glaucoma, whereas the high-salt diet increased patients' risk of developing the disease and experiencing progression.

  An increased consumption of omega-3 fatty acids was associated with a decreased risk of developing glaucoma. The published data on vitamin supplementation were found to be limited. Finally, especially at high doses, supplements such as selenium, iron, zinc, and calcium were associated with a possible, slightly increased risk of glaucoma.

WHY IT MATTERS

This review suggests that patients at risk of developing glaucoma or experiencing disease progression could benefit from a Mediterranean diet that is low in salt and an increased intake of omega-3 fatty acids. Whereas the value of nutritional supplements for glaucoma prevention was not clear, dietary modifications offered patients benefits without significant risk.

DISCUSSION

Conflicting dietary recommendations can confuse patients. This review by Yang et al highlighted that, by following an antiinflammatory diet consisting of whole, unprocessed foods (consistent with the Mediterranean diet) and limiting their consumption of salt, patients may be able to reduce their risk of developing glaucoma and slow its progression.[4] Multiple pathways, including poor blood flow, oxidative stress, and mitochondrial dysfunction, have been associated with optic nerve damage in glaucoma.[11] It therefore seems reasonable that maintaining a healthy, antiinflammatory, antioxidant-rich diet that supports mitochondrial health could help reduce the incidence and severity of the disease.

Some vitamin B supplements have shown great potential for altering disease progression.[12] There may be a critical threshold, however, beyond which minerals such as zinc, iron, selenium, and calcium negatively influence glaucoma risk and disease progression. Further research is required to refine recommendations on dietary intake. When discussing nutritional supplements with patients, clinicians should be honest about the limits of current understanding and cautious in recommending specific vitamin and mineral supplementation.

Michael Pollan, journalist, professor, and author of several well-known

books on nutrition, famously summed up healthy eating in seven words: "Eat food, not too much, mostly plants." The review by Yang and colleagues[4] supports this simple mantra. Advising patients to reduce their salt intake and adopt an antiinflammatory diet could reduce their risk of glaucoma and improve their overall health and quality of life. ■

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