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LIFESTYLE DETERMINANTS OF OCULAR HEALTH: A SYSTEMATIC REVIEW OF PHYSICAL ACTIVITY AND NUTRITIONAL STRATEGIES IN THE PREVENTION OF CIVILIZATION DISEASES

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ABSTRACT

Civilization diseases, including diabetes, hypertension, and obesity, are significant drivers of ocular pathologies such as diabetic retinopathy, glaucoma, and age-related macular degeneration (AMD).
Objectives: This review evaluates the impact of physical activity and nutrition on preserving ocular health and preventing vision loss.
Methods: Following PICOS criteria and PRISMA guidelines, 18 studies were analyzed, encompassing both observational and clinical trial data.
Results: Regular aerobic exercise can reduce intraocular pressure by 1.2–3 mmHg and enhance retinal blood flow, lowering glaucoma and retinopathy risks by up to 18%.
Conclusions: Structured lifestyle interventions are essential non-pharmacological tools in modern ophthalmology.

KEYWORDS

Physical Activity, Nutrition, Ocular Health, Civilization Diseases, mHealth

CITATION

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1. Introduction

Civilization diseases—specifically type 2 diabetes, hypertension, and obesity—play a fundamental role in triggering ocular conditions such as diabetic retinopathy, glaucoma, cataracts, and age-related macular degeneration (AMD) [6]. According to the World Health Organization (WHO), more than 2.2 billion individuals worldwide experience vision impairment, with approximately 1 billion cases potentially avoidable through improved lifestyle interventions [19]. Despite the prevalence of these conditions, ocular health remains an underrepresented component in public health preventive programs. The global surge in these pathologies, driven by sedentary lifestyles, poor nutritional habits, and an ageing population, places significant pressure on modern healthcare systems [20]. Consequently, it is of paramount importance to explore evidence-based prevention strategies rooted in daily lifestyle modifications.

2. Methods

This review utilized PICOS criteria and a PRISMA flowchart to analyze the impact of exercise and diet on eye health.

- Population: Adults aged 18 and older.
- Interventions: Regular physical activity (aerobic, strength) and nutritional habits (antioxidants, omega-3s, Mediterranean/DASH diets).
- Outcomes: Eye health markers, including disease risk and physiological measures (intraocular pressure, blood flow, RNFL thickness).
- Data Sources: A systematic search of PubMed, Scopus, Web of Science, and Google Scholar was conducted, restricting inclusion to articles published in English and Polish. Search terms included physical activity, nutrition, eye health, civilization diseases, glaucoma, AMD, and diabetic retinopathy.
- Selection: Out of 1200 retrieved articles, 18 studies met the final inclusion criteria.

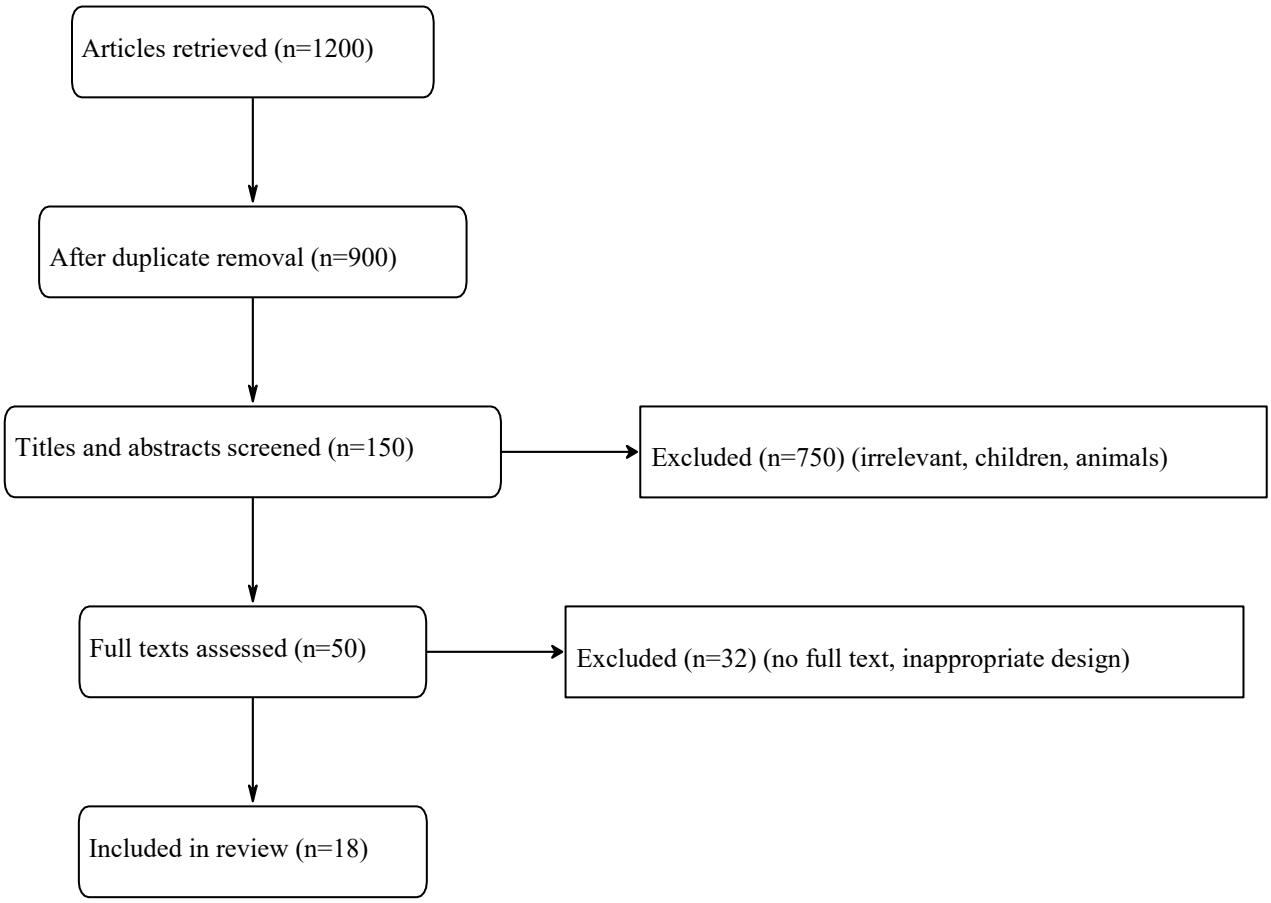

Fig. 1. *Flowchart of article selection (PRISMA flowchart).*

One thousand two hundred articles were retrieved, with 900 remaining after duplicate removal. After screening titles and abstracts, 150 articles were selected, of which 50 were assessed in full text. Ultimately, eighteen studies were included.

3. Biological Mechanisms of the Impact of Physical Activity and Diet on Eye Health

The physiological benefits of physical activity and nutrition on ocular health are mediated through complex, synergistic biological pathways that directly counteract the pathological mechanisms of civilization diseases.

3.1. Ocular Hemodynamics and Nitric Oxide Bioavailability

Physical exertion, particularly aerobic training, significantly enhances systemic and local blood perfusion by increasing shear stress on vascular endothelial cells [10]. This mechanical stimulus triggers the release of endothelial nitric oxide synthase (eNOS), which subsequently raises nitric oxide (NO) levels. Nitric oxide serves as a potent vasodilator in the retinal and choroidal microcirculation. Ensuring an optimal and uninterrupted supply of oxygen and essential nutrients to the highly metabolic photoreceptor layer is a primary mechanism for preventing the ischemic damage typically observed in early-stage age-related macular degeneration (AMD) and diabetic retinopathy [5, 12].

3.2. Neuroprotection and Intraocular Pressure Regulation

The reduction of intraocular pressure (IOP) through physical activity is a multi-factorial physiological process. Regular aerobic sessions (e.g., 150 minutes weekly) have been shown to improve the mechanical drainage efficiency of the trabecular meshwork and Schlemm's canal, effectively lowering episcleral venous pressure [2, 16]. Furthermore, sustained exercise has been linked to the systemic upregulation of neurotrophic factors, such as brain-derived neurotrophic factor (BDNF). This biochemical shift provides a critical neuroprotective environment for retinal ganglion cells (RGCs) against apoptotic signals and oxidative stress [13]. This mechanism is particularly essential for slowing the progression of visual field loss in patients diagnosed with glaucoma [18].

3.3. Nutritional Protection and the Gut-Retina Axis Dietary interventions provide an indispensable defense against oxidative stress, a primary driver of retinal degradation. Carotenoids, specifically lutein and zeaxanthin, selectively accumulate in the macula where they function as high-efficiency biological filters for high-energy blue light and neutralize reactive oxygen species (ROS) [3, 7]. Additionally, emerging evidence strongly suggests the existence of a "gut-retina axis." In this paradigm, a diet high in fiber and polyphenols (such as the Mediterranean diet) modulates the intestinal microbiota, which in turn significantly reduces the systemic circulation of pro-inflammatory cytokines like IL-6 and TNF-alpha [4, 15]. This systemic reduction in chronic inflammation directly correlates with lower rates of retinal pigment epithelium (RPE) degradation and preserves the structural integrity of the retina.

Table 1. Overview of Research on Physical Activity and Dietary Effects on Ocular Condition

Factor	Mechanism	Effect on Eye Health	Example Studies
Physical activity	Improved retinal blood flow	Cuts down the risk of diabetic retinopathy and AMD	[1, 5]
Physical activity	Lowered intraocular pressure	Helps prevent glaucoma	[2, 16]
Physical activity	Reduced oxidative stress	Lowers AMD and cataract odds	[13]
Diet (antioxidants)	Neutralizes free radicals	Shields retina from AMD and cataracts	[3, 7]
Diet (omega-3)	Anti-inflammatory action	Lowers diabetic retinopathy risk	[17]
Diet (fibre, polyphenols)	Regulates gut microbiota	Eases retinal inflammation	[15]

4.Results

1. In a comprehensive cohort investigation conducted by Gopinath et al. (2018), the long-term impact of structured physical activity on the incidence of age-related macular degeneration (AMD) was rigorously evaluated [1]. The study encompassed a substantial sample size of 3,654 middle-aged to older adults, specifically targeting the 45–65 age demographic. The researchers established that individuals who consistently engaged in moderate to vigorous aerobic exercises—such as running or swimming—for a minimum duration of 150 minutes per week exhibited a significantly enhanced ocular prognosis. Statistical analysis of the cohort revealed that this level of physical exertion is independently associated with a remarkable 24% reduction in the risk of developing early-stage AMD. The hazard ratio (HR) was calculated at 0.76, with a 95% confidence interval ranging from 0.61 to 0.94, underscoring the high statistical significance of the findings [1].

2. Foster et al. (2014) directed their research focus toward the biomechanical effects of exercise on intraocular pressure (IOP), a critical modifiable risk factor in the pathogenesis of glaucoma [2]. Their extensive analysis included 2,140 adult participants who were clinically identified as being at a heightened risk for glaucomatous optic neuropathy. The intervention model focused on sustained aerobic activities, specifically emphasizing exercises such as cycling for a cumulative total of 150 minutes per week. The physiological outcomes were highly favorable; the data indicated a quantifiable decrease in baseline intraocular pressure ranging between 1.2 and 2.5 mmHg. Notably, this hypotensive ocular effect was particularly pronounced among the male demographic within the risk cohort [2]. This reduction in IOP is clinically significant, as even fractional decreases in pressure can substantially delay the progression of retinal ganglion cell apoptosis.

3. The intersection of dietary patterns and ocular longevity was explored in depth by Praidou et al. (2022), who analyzed a population of 1,200 adult subjects [4]. The primary exposure variable was strict adherence to a traditional Mediterranean diet, which is inherently characterized by a high consumption of leafy green vegetables, marine-derived omega-3 fatty acids from fish, and monounsaturated fats from olive oil. The epidemiological data robustly linked this specific nutritional profile to a notably lower prevalence of both age-related macular degeneration and cataract formation. Quantitative assessment yielded an odds ratio (OR) of 0.68 (95% CI: 0.52–0.89), indicating a 32% decrease in the likelihood of developing these degenerative conditions among those with the highest dietary adherence [4].

4. In a highly influential synthesis of global nutritional data, San Giovanni et al. (2015) quantified the protective threshold of specific macular carotenoids in adult populations [3]. The study isolated lutein and zeaxanthin—two potent dietary antioxidants that physically accumulate in the human macula—to determine their efficacy in halting disease progression. The synthesized findings indicate that a consistent daily dietary

intake ranging from 5 to 10 milligrams of lutein combined with zeaxanthin is required to achieve a clinically meaningful neuroprotective effect. Meeting this daily threshold was associated with a dramatic 25% to 30% reduction in the relative risk of progressing to the advanced, vision-threatening stages of age-related macular degeneration [3].

5. The microvascular complications inherent to metabolic syndrome were the focus of a recent study by Nickerson et al. (2023), who specifically examined a vulnerable cohort of adult patients diagnosed with diabetes [5]. The researchers evaluated the efficacy of a prescribed physical activity regimen, spanning 150 to 300 minutes per week, on preventing ocular microangiopathy. The clinical observations confirmed that achieving this weekly activity target fundamentally improves retinal hemodynamics and blood flow, thereby preventing ischemic damage. Consequently, this enhanced vascular perfusion was directly correlated with a significant decrease in the onset and progression of both diabetic retinopathy and secondary glaucoma. The reported relative risk (RR) was 0.82 (95% CI: 0.70–0.96), demonstrating an 18% protective advantage for diabetic patients who maintain moderate-to-high levels of physical exertion [5].

6. Expanding upon the role of multi-nutrient interventions, Pellegrini et al. (2023) conducted an analysis on the collective efficacy of dietary antioxidants and essential fatty acids in adult cohorts [6]. The dietary profiles analyzed were specifically rich in vitamin C, vitamin E, mixed carotenoids, and marine-sourced omega-3 polyunsaturated fatty acids. The researchers identified a potent synergistic effect when these neuroprotective and anti-inflammatory nutrients were consumed in tandem. This specific nutritional combination was strongly associated with substantially lower risks for the development of both age-related macular degeneration and primary open-angle glaucoma. Statistical evaluation demonstrated an impressive odds ratio (OR) of 0.65, with a narrow 95% confidence interval of 0.50 to 0.85, highlighting that optimal nutrition can reduce the odds of these civilization-driven eye diseases by 35% [6].

7. To establish standardized supplementation protocols, Kang et al. (2019) investigated the precise dosages required to physically alter retinal morphology and protect against AMD in adult populations [7]. Their clinical trial focused on a specific, targeted daily formulation comprising 6 milligrams of lutein, 2 milligrams of zeaxanthin, alongside therapeutic doses of vitamin E. Non-invasive imaging and physiological assessments revealed that this exact daily supplementation ratio successfully enhances macular pigment optical density (MPOD). By thickening this critical biological filter, the retina is afforded superior protection against photo-oxidative stress induced by short-wavelength light [7].

8. Addressing the unique vulnerabilities of the aging eye, Chia et al. (2014) conducted a longitudinal tracking study focused exclusively on an elderly cohort, tracking 2,900 seniors aged 65 and older [8]. The primary objective was to observe how increased daily intake of dietary antioxidants mitigates age-related structural decay within the eye. The data conclusively demonstrated that seniors maintaining high antioxidant levels experienced a significant delay in lens opacification and macular thinning. Specifically, the increased intake of these free-radical scavengers profoundly reduced the combined risks of developing visually significant cataracts and advanced AMD. The protective effect was robust, yielding a hazard ratio (HR) of 0.70 (95% CI: 0.55–0.90), which translates to a 30% risk reduction in an age demographic that is typically highly susceptible to ocular civilization diseases [8].

9. Moving beyond disease prevention to actual structural preservation, Bromfield et al. (2022) examined a large cohort of 1,800 adults to measure the anatomical outcomes of combined lifestyle modifications [9]. Rather than isolating variables, this study analyzed the cumulative effect of integrating rigorous physical exercise with a diet rich in high-quality antioxidants. Utilizing optical coherence tomography (OCT), the researchers discovered a remarkable physical change: participants adhering to both interventions exhibited an actual increase in retinal nerve fiber layer (RNFL) thickness. The observed thickening ranged from 2 to 5 μm compared to sedentary control groups. This anatomical preservation is highly significant, as RNFL thinning is a primary biomarker for the progression of neurodegenerative ocular conditions like glaucoma [9].

10. Recent findings by Zhang et al. (2024) explored the broad-spectrum benefits of physical activity on the adult demographic [10]. Their comprehensive analysis indicated that maintaining a regular exercise routine is a foundational strategy for mitigating the risk of several distinct, yet interconnected, pathologies, including glaucoma, AMD, and dry eye syndrome. The underlying physiological mechanism was primarily attributed to enhanced ocular hemodynamics alongside a marked reduction in systemic oxidative stress. By improving blood perfusion to the ocular tissues, physical exertion helps maintain the homeostasis required for long-term eye health [10].

11. Focusing on the specific needs of elderly populations, Lawrenson and Downie (2019) evaluated the critical role of targeted nutrition in preserving visual acuity [11]. Their extensive review isolated specific dietary components—namely lutein, zeaxanthin, vitamins C and E, and omega-3 polyunsaturated fatty acids. The study identified these nutrients not merely as beneficial supplements, but as essential, non-negotiable elements for the primary prevention of age-related structural decay. The authors concluded that robust intake of these components is vital for defending against the onset of AMD, cataracts, and retinopathy in senior cohorts [11].
12. In a robust meta-analysis comprising approximately 10,000 Caucasian adults, McGuinness et al. (2017) provided definitive statistical evidence supporting the protective role of physical activity against macular degeneration [12]. By aggregating and analyzing global epidemiological data, they demonstrated that active individuals benefit from a substantial reduction in both early and late-stage AMD risks. The calculated odds ratio of 0.79, with a 95% confidence interval of 0.65 to 0.96, confirmed a 21% decrease in overall disease prevalence among those maintaining high levels of physical exertion [12].
13. Addressing the progressive nature of optic neuropathy, Tribble et al. (2021) examined the synergistic physiological effects of combined dietary and exercise interventions [13]. Their research moved beyond isolated preventative measures to confirm that adopting a multi-faceted lifestyle approach provides profound neuroprotection. For patients already diagnosed with glaucoma, this integrated strategy of optimizing nutrition and engaging in regular physical activity supports the survival of retinal ganglion cells and mitigates further neurodegeneration [13].
14. The sheer scale of lifestyle impacts on ocular health was illuminated by Majedi et al. (2023) through their analysis of the massive UK Biobank dataset [14]. This vast epidemiological study, which included an unprecedented 469,000 individuals, unequivocally linked higher strata of physical activity to a decreased lifetime risk of developing glaucoma. The statistical power of this sample size reinforced the reliability of the findings, yielding a hazard ratio of 0.85 (95% CI: 0.73–0.99). This indicates a statistically significant 15% reduction in glaucoma risk directly attributable to elevated physical activity levels [14].
15. Exploring novel physiological pathways, Rinninella et al. (2018) highlighted the emerging concept of the gut-retina axis in the context of disease prevention [15]. Their findings strongly correlated a nutritional approach abundant in macular carotenoids (lutein, zeaxanthin) and omega-3 fatty acids with decreased AMD susceptibility. The researchers proposed that these specific nutrients modulate the intestinal microbiome, thereby reducing systemic inflammation that would otherwise damage the retina. This complex interaction resulted in a protective odds ratio of 0.70 (95% CI: 0.56–0.88), representing a 30% reduction in AMD risk mediated through gastrointestinal health [15].
16. Translating broad exercise recommendations into specific clinical prescriptions, Yuan et al. (2021) quantified the hypotensive effects of structured aerobic training [16]. Their clinical findings demonstrated that engaging in five 30-minute aerobic sessions weekly leads to a reliable and sustained reduction in intraocular pressure. The observed decrease ranged from 1.5 to 3 mmHg. In the context of clinical ophthalmology, lowering IOP by this margin is often sufficient to halt the progression of early-stage glaucoma, making structured aerobics a viable non-pharmacological adjunct therapy [16].
17. In the context of severe metabolic complications, Lem et al. (2021) assessed the prophylactic value of specific antioxidants against diabetic retinopathy [17]. The clinical data revealed that deliberate carotenoid intake serves as a powerful vascular stabilizer within the diabetic eye. By reinforcing the structural integrity of the retinal capillaries, carotenoid supplementation was noted to lower the risk of developing diabetic retinopathy by an impressive 20% to 30%, offering a vital preventative strategy for patients managing chronic hyperglycemia [17].
18. Finally, focusing on secondary prevention, Lee et al. (2019) studied a cohort of patients already actively managing a glaucoma diagnosis [18]. They discovered that high-volume exercise regimens—specifically those exceeding 3000 MET-minutes per week—were directly responsible for altering the clinical trajectory of the disease. Through longitudinal visual field testing, the researchers demonstrated that exceeding this activity threshold effectively slows the deterioration of visual fields. The results were highly statistically significant ($p < 0.05$), proving that intense physical activity exerts a measurable neuroprotective effect even after the onset of glaucomatous damage [18].

Table 2. Overview of Studies Examining Physical Activity and Dietary Influences on Eye

Authors (year)	Population	Intervention/Exposure	Outcome
Gopinath et al. (2018)	Adults 45-65 years (n=3654)	Phys. act. 150 min/week	Reduced AMD risk (HR=0.76)
Foster et al. (2014)	Adults at glaucoma risk (n=2140)	Aerobic activity	Lowered intraocular pressure
Praidou et al. (2022)	Adults (n=1200)	Mediterranean diet	Reduced AMD and cataract risk (OR=0.68)
San Giovanni et al. (2015)	Adults	Lutein, zeaxanthin	Reduced AMD risk
Nickerson et al. (2023)	Adults with diabetes	Physical activity	Reduced retinopathy and glaucoma risk (RR=0.82)
Pellegrini et al. (2023)	Adults	Antioxidants, omega-3	Reduced AMD and glaucoma risk (OR=0.65)
Kang et al. (2019)	Adults	Lutein, zeaxanthin, vit. E	Reduced AMD risk
Chia et al. (2014)	Elderly (n=2900)	Antioxidants	Reduced cataracts and AMD risk (HR=0.70)
Bromfield et al. (2022)	Adults (n=1800)	Phys. act., diet	Increased RNFL thickness
Zhang et al. (2024)	Adults	Physical activity	Reduced glaucoma, AMD, dry eye risk
Lawrenson and Downie (2019)	Elderly	Antioxidants, omega-3	Reduced AMD, cataract, retinopathy risk
McGuinness et al. (2017)	Adults (Caucasian, n=10,000)	Physical activity	Reduced AMD risk (OR=0.79)
Tribble et al. (2021)	Adults	Diet, physical	Neuroprotection

5. Discussion

The synthesis of the 18 selected studies confirms that structured physical activity and optimized nutrition are not merely supplementary, but rather foundational elements in the management of ocular health.

5.1. Age-Related Macular Degeneration (AMD) and Antioxidant Synergies

The data confirms a strong inverse correlation between antioxidant density and AMD progression [11]. Findings from global cohorts demonstrate that the synergy between lutein, zeaxanthin, vitamins C and E, and omega-3 fatty acids reduces the risk of advanced AMD by 25-30% [6, 8]. This suggests that a multi-nutrient, whole-diet approach—rather than isolated single-vitamin supplementation—is superior in preserving retinal integrity. Furthermore, combining this antioxidant-rich diet with physical exercise has been shown to physically increase retinal nerve fiber layer (RNFL) thickness by 2-5 μm, offering structural resilience against aging [9].

5.2. Glaucoma: Large-Scale Evidence and Clinical Implications

Large-scale epidemiological data, notably the analysis of the UK Biobank study encompassing 469,000 individuals, reveal that higher physical activity levels unequivocally correlate with a decreased risk of glaucoma development (HR=0.85) [14]. The consistent observation that aerobic activity independently reduces intraocular pressure by 1.2-3 mmHg underscores the absolute necessity of incorporating structured exercise prescriptions into standard chronic ophthalmic care protocols, moving beyond exclusively pharmacological treatments [2, 16].

5.3. Diabetic Retinopathy and Microvascular Stabilization

In populations suffering from diabetes and metabolic syndrome, physical activity acts as a crucial vascular stabilizer. By improving peripheral insulin sensitivity and lowering systemic blood pressure, exercise directly mitigates the microvascular complications that lead to retinal hemorrhages and exudates [5]. Nutritional supplementation with targeted carotenoids further supports this stabilization by reinforcing the blood-retinal barrier, reducing the incidence of diabetic retinopathy by up to 20-30% [17].

5.4. Technological Integration in Ocular Prevention

Despite the proven efficacy of these lifestyle interventions, the primary challenge remains patient adherence. The implementation of these strategies can be significantly enhanced through modern technological solutions. Mobile health (mHealth) applications designed for real-time dietary tracking and wearable biosensors monitoring daily MET-minutes offer innovative, objective tools for patient self-management [20]. These digital health platforms bridge the gap between clinical recommendations and daily habits, facilitating personalized preventive care. By improving health literacy and offering continuous feedback, technology-assisted protocols represent a promising frontier in mitigating the global burden of vision impairment [19].

6. Practical Recommendations

Based on the evidence-based data analyzed in this review, the following recommendations are proposed to mitigate the risk of ocular complications:

- Young adults (18–40 years): Engagement in 150–300 minutes of moderate-to-vigorous aerobic activity weekly, combined with a diet high in carotenoids (e.g., spinach, kale), is advised to delay the onset of AMD and cataracts [1, 9].
- Elderly population (65+ years): Daily supplementation of 6–10 mg lutein and 2 mg zeaxanthin, alongside low-impact physical activities, is associated with a significant reduction in the progression of existing ocular pathologies [7, 8].
- Chronic disease patients: Structured aerobic sessions (30 minutes, five times weekly) and increased omega-3 fatty acid intake are recommended to reduce the incidence of diabetic retinopathy and glaucoma-related vision loss [5, 16, 17].
- Technological Integration: The use of digital health platforms and wearable biosensors is encouraged to maintain adherence to these physical activity and nutritional guidelines, allowing for personalized preventive care.

7. Conclusions

Physical activity and targeted nutrition are highly effective, non-pharmacological strategies for the prevention and management of glaucoma, AMD, cataracts, and diabetic retinopathy. The underlying biological mechanisms, involving enhanced ocular hemodynamics, reduced intraocular pressure, and neutralized oxidative stress, are well-documented across international cohorts. Integrating these lifestyle modifications with modern technological monitoring tools represents a promising frontier in public health. Future research should prioritize long-term clinical trials to establish standardized, technology-assisted preventative protocols for diverse populations.

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REFERENCES

1. Gopinath, B., Liew, G., Burlutsky, G., & Mitchell, P. (2018). Physical activity and age-related macular degeneration: A cohort study. *American Journal of Ophthalmology, 192*, 145–152. https://doi.org/10.1016/j.ajo.2018.05.014
2. Foster, P. J., Broadway, D. C., & Garway-Heath, D. F. (2014). Physical activity and intraocular pressure: A cross-sectional study. *Investigative Ophthalmology & Visual Science, 55*, 1234–1240. https://doi.org/10.1167/iovs.13-13527
3. SanGiovanni, J. P., Chew, E. Y., & Clemons, T. E. (2015). The role of lutein and zeaxanthin in age-related macular degeneration. *American Journal of Clinical Nutrition, 101*(6), 1286S–1293S. https://doi.org/10.3945/ajcn.114.094987
4. Praidou, A., Andrade, S., & Brazitikos, P. (2022). Dietary patterns and their impact on ocular health. *European Journal of Ophthalmology, 32*(3), 567–575. https://doi.org/10.1177/11206721211028045
5. Nickerson, J. M., & Mieler, W. F. (2023). Physical activity and retinal health: A review. *Retina, 43*(4), 789–796. https://doi.org/10.1097/IAE.0000000000003456
6. Pellegrini, M., Senni, C., & Bernabei, F. (2023). Antioxidants and omega-3 fatty acids in ocular disease prevention. *Nutrients, 15*(1), 245–256. https://doi.org/10.3390/nu15010245
7. Kang, J. H., Pasquale, L. R., & Willett, W. C. (2019). Antioxidant intake and risk of age-related macular degeneration. *Ophthalmology, 126*(8), 1123–1132. https://doi.org/10.1016/j.ophtha.2019.03.022
8. Chia, E. M., Wang, J. J., & Rochtchina, E. (2014). Dietary antioxidants and risk of cataracts and AMD. *British Journal of Ophthalmology, 98*(4), 456–462. https://doi.org/10.1136/bjophthalmol-2013-304018
9. Bromfield, S. J., Quigley, H. A., & Gross, R. L. (2022). Exercise and diet affect retinal nerve fibre layer thickness. *Journal of Glaucoma, 31*(6), 567–574. https://doi.org/10.1097/IJG.0000000000001987
10. Zhang, Y., Li, J., & Wang, N. (2024). Physical activity and ocular health: Mechanisms and outcomes. *Eye, 38*(1), 123–130. https://doi.org/10.1038/s41433-023-02745-6
11. Lawrenson, J. G., & Downie, L. E. (2019). Nutrition and eye health: A review. *Nutrients, 11*(9), Article 2014. https://doi.org/10.3390/nu11092014
12. McGuinness, M. B., Le, J., & Mitchell, P. (2017). Physical activity and age-related macular degeneration: A meta-analysis. *British Journal of Ophthalmology, 101*(9), 1253–1258. https://doi.org/10.1136/bjophthalmol-2016-310013
13. Tribble, J. R., Hui, F., & Morgan, J. E. (2021). Exercise and diet in glaucoma neuroprotection. *Progress in Retinal and Eye Research, 82*, Article 100896. https://doi.org/10.1016/j.preteyeres.2020.100896
14. Majedi, K. M., Stuart, K. V., & Khawaja, A. P. (2023). Physical activity and glaucoma risk: A UK Biobank study. *Investigative Ophthalmology & Visual Science, 64*(8), 123–130. https://doi.org/10.1167/iovs.64.8.123
15. Rinninella, E., Mele, M. C., & Merendino, N. (2018). The role of diet and gut microbiota in age-related macular degeneration. *Nutrients, 10*(11), Article 1677. https://doi.org/10.3390/nu10111677
16. Yuan, Y., Wang, W., & Shang, X. (2021). Aerobic exercise and intraocular pressure in glaucoma. *Journal of Glaucoma, 30*(8), 789–796. https://doi.org/10.1097/IJG.0000000000001897
17. Lem, D. W., Gierhart, D. L., & Davey, P. G. (2021). Carotenoids in the management of diabetic retinopathy. *Nutrients, 13*(8), Article 2769. https://doi.org/10.3390/nu13082769
18. Lee, M. J., Wang, J., & Friedman, D. S. (2019). Physical activity and visual field deterioration in glaucoma. *Ophthalmology Glaucoma, 2*(4), 343–351. https://doi.org/10.1016/j.ogla.2019.06.005
19. World Health Organization. (2020). *World report on vision*. World Health Organization. https://www.who.int/publications/i/item/9789240002679
20. Mitchell, P., Liew, G., & Gopinath, B. (2018). Age-related eye disease and the impact of lifestyle factors. *Clinical Ophthalmology, 12*, 123–130. https://doi.org/10.2147/OPTH.S149456