



Fast Food and Malnutrition can lead to Blindness and Structural Changes in the Central Nervous System (CNS)

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Abstract

Background: An increasing awareness regarding consumption of fast food in early childhood and blindness with serious metabolic changes combined with morphological changes in the central nervous system should be considered.

Method: This study conducted a systematic search in the PubMed database for articles related to Optic Neuropathy. The only risk factor was malnutrition due to fast food consumption, which led to Blindness due to nutritional optic neuropathy.

Discussion and Conclusion: Early detection and management could prevent permanent loss of vision in both eyes, or at least protect the only Seeing Eye. Educational programs are required to encourage children to follow healthy eating habits and to emphasize the serious effects of fast food on vision. Routine screening in schools and pediatric clinics including detailed dietary history is mandatory early detection and prevention of potential complications.

Keywords: Blindness; Fast Food; Junk Food; Malnutrition; Nutritional Optic Neuropathy; Optic Neuropathy; Screening Program; Social Awareness; Vitamin Deficiency

Abbreviations: ARFID: Avoidant/Restrictive Food Intake Disorder; ATP: Adenosine Triphosphate; BMI: Body Mass Index; CNS: Central Nervous System; MRI: Magnetic Resonance Imaging; NCDs: Non-Communicable Diseases; PN: Parenteral Nutrition; OD: Oculus Dexter; OS: Oculus Sinister; OU: Oculus Uterque; OCT: Optical Coherence Tomography; SCD: Sub-Acute Combined Degeneration; VEP: Visual Evoked Potential; RNFL: Retinal Nerve Fiber Layer; WMHs: White Matter Hyperintensities.

Introduction

Nutritional optic neuropathy is a condition that can occur as a result of malnutrition, particularly deficiency in essential vitamins such as vitamin B₁, B₁₂, and E. These deficiencies can cause structural changes in the central nervous system

that can lead to vision loss and even blindness. Sudden loss of vision, or blindness, secondary to optic nerve neuropathy is uncommon at a young age. The main causes include compressive, vascular, toxic, nutritional, infectious, neoplastic, hereditary, and traumatic [1]. Vitamin deficiencies (especially vitamin A) are associated with serious diseases of the human retina [2]. Lifestyle changes over the past two decades have led to an increase in the consumption of fast food. The quality and quantity of the food chosen can lead to an insufficient supply of specific essential micronutrients such as vitamins and trace elements [3]. Consequently, the incidence of nutritional neuropathy increased dramatically with easy access to fast food and the increase in tobacco and alcohol consumption which results in malnutrition, including for micronutrients. Urgent attention is needed to address the problem of malnutrition, including vitamin deficiencies in

highly developed countries.

Materials and Methods

This study conducted a systematic search in the PubMed database for articles related to Nutritional Optic Neuropathy from January 2000 to December 2022. The author used specific keywords to search for articles on Optic neuropathy, Fast Food, Junk food, Nutritional optic neuropathy, Malnutrition, Blindness, Vitamin deficiency, MRI, Central nervous system and reviewed all articles to select those that reported complications and adverse events such as optic neuropathy and structural changes in the central nervous system associated with Fast food and Malnutrition. There have been numerous studies and cases that have reported the negative effects of fast food on the eyes and central nervous system (CNS). Fast food consumption has also been linked to an increased risk of developing neurological conditions such as Alzheimer's and Parkinson's disease, as well as depression, anxiety, and other CNS disorders. Additionally, fast food can also worsen the symptoms of existing eye and CNS disorders such as diabetic retinopathy, multiple sclerosis, and brain tumors. It is important to note that while these studies and cases have found an association between fast food consumption and negative effects on the eyes and CNS; more research is needed to fully understand the extent of these effects. However, a healthy diet that is low in saturated and high in fruits, vegetables, and whole grains is beneficial for maintaining good eye and brain health.

To illustrate, a reported case of a 17-year-old male complained of progressive vision loss consistent with optic neuropathy. Visual acuity was very poor, color vision was impaired, and there were central visual field defects and loss of retinal nerve fibers. Neurologic examination was normal except for brisk reflexes. MRI showed no compressive or inflammatory lesions and genetic tests for Leber hereditary optic neuropathy were negative. Laboratory evaluation revealed functional vitamin B₁₂ deficiency as indicated by elevated homocysteine and methylmalonic acid levels, despite normal vitamin B₁₂ levels. The patient was a "fussy eater" who primarily consumed junk foods which are nutritionally poor but high in calories. This type of diet is associated with a high body mass index (BMI), low socioeconomic status, and poor health. This type of "fussy eating" that only includes junk food and leads to multiple nutritional deficiencies can be considered an eating disorder called Avoidant-restrictive food intake disorder. This disorder typically starts in middle childhood and is characterized by a lack of interest in food, sensitivity to food textures, and fear of the consequences of eating. The individual's BMI is often normal. It is important to consider nutritional optic neuropathy in anyone with unexplained vision symptoms and poor diet, regardless of their BMI. This condition is treatable if discovered early, but

if left untreated it can lead to permanent blindness [4].

A large cohort study found a connection between poor nutrition, specifically protein energy malnutrition, and the presence of severe White matter hyper intensities (WMHs) in 359 older adults. Low levels of vitamins B₁ and B₁₂ were also linked to the presence of severe WMHs, and these associations were not influenced by cognitive status or depression symptoms. Future studies are planned to further investigate the relationship between malnutrition, micronutrient deficiencies, and structural changes in the brain, with the goal of creating dietary guidelines and recommendations for targeted interventions [5]. A study demonstrated a case study of an 18-year-old male presented to an ophthalmology clinic with a complaint of progressive visual loss. At examination, he appeared pale and had no physical complaints other than the visual loss. He was unable to see any figures on the Ishihara color plates but could identify colors on large objects with each eye. His visual acuity was 20/600 bilaterally, and an Optical coherence tomography scan (OCT) revealed severe bilateral optic disk edema. Other features included a slight thickening of the Retinal nerve fiber layer (RNFL), full peripherally visual fields with bilateral central scotomas to confrontation, full reactivity of both pupils to light, and full extraocular movements. His mother expressed concern about his diet and described him as a "picky eater" with a limited range of foods. He was diagnosed with "Bilateral optic neuropathy due to nutritional deficiency" and referred to the psychiatry clinic to further examination of his eating habits [6].

Parenteral nutrition (PN) is used via a central venous catheter in surgical patients without a functioning gastrointestinal tract. Its complications could be metabolic and thrombotic, and blindness is a rare and unexpected complication. A case of a young female patient who experienced sudden, painless, bilateral complete loss of vision while receiving PN through a central venous catheter. Examination revealed a brain infarct and there was no cardiac source of the blood clot. After supportive treatment, the patient's vision improved and returned to normal after one month. The blindness secondary to central venous catheterization is very rare and possible mechanisms are venous thrombosis with paradoxical emboli, air emboli, or accidental arterial puncture. It also emphasizes the importance of clinicians to exercise caution while using PN and have a high index of suspicion to diagnose and treat unexpected complications [7].

A case of a 17-year-old male patient with Avoidant/Restrictive Food Intake Disorder (ARFID) and illustrates the multiple health problems that can occur because of nutritional deficiencies in an adolescent of normal weight. The patient was diagnosed with sub-acute combined degeneration

(SCD) of the spinal cord, a serious condition that can lead to irreversible damage. This case is the first reported instance of SCD of the spinal cord due to ARFID. Investigations showed multiple vitamin deficiencies including Vitamin A, E, K, D, B₁₂, and folate. Treatment included vitamin replacement, nasogastric feeding, and the gradual introduction of a varied diet. The patient should require long-term rehabilitation. The passage emphasizes the importance of recognizing abnormal eating patterns in children and adolescents and seeking specialist care early [8].

Discussion

Nutritional optic neuropathy, a condition which can lead to vision loss and even blindness, can be caused by a diet high in processed and fast foods, which can lead to malnutrition. This is because these foods are often lacking in essential vitamins and minerals and can cause structural changes in the central nervous system (CNS). To avoid this, it is important to maintain a balanced diet that includes a variety of nutrient-dense foods to ensure adequate intake of essential vitamins and minerals. The success of the treatment of diet-related optic neuropathy is time-dependent and depends on the severity and duration of the nutritional deficiency. Repleting Vitamin B₁₂ is crucial, and recovery of the visual function may require months to years. Other causes of vitamin B₁₂ deficiency such as pernicious anemia, inflammatory bowel diseases, infections and drugs were excluded [9].

Various classes of nutrients are essential for maintaining the function and integrity of the eye, especially for patients with macular diseases. Due to its unique anatomy, the macula is particularly rich in antioxidants that are replenished through food elements. Food rich in macular pigments such as lutein and zeaxanthin play an important role in slowing down the development and progression of age-related macular degeneration according to AREDS2 [10]. Vitamin B₁₂ is a cofactor in the production of succinyl CoA which is an integral part of the Krebs cycle that produces adenosine triphosphate (ATP) [11]. Impairment of oxidative metabolism causes ATP depletion but due to the high metabolic demand of the papillo-macular bundle in the retina, this damages the papillo-macular bundle fibers resulting in optic nerve neuropathy [12]. Vitamin A supplementation is crucial for the regeneration of pigments necessary for vision [13]. In a cohort study of patients with bilateral painless loss of vision associated with vitamin A deficiency, vitamin A supplementation resulted in stabilization of their vision and visual fields [14]. Vitamin B₁₂ deficiency secondary to the so-called lifestyle diet caused by a vegan or vegetarian diet can result in neuropathies and even psychoses, yet there remains a lack of research regarding damage to the optic nerve or its axons [15].

An increase in chronic non-communicable diseases (NCDs) is observed worldwide regardless of the economic status of the countries or populations. These diseases include diabetes mellitus, hypertension, and cancers according to WHO [16-18]. Recently, numerous studies suggested that "Fast Food" might contribute to the increase in NCDs. Rauber et al. was able to prove through data analysis of the National surveys in the UK that more than half of the energy comes from the diet through ultra-processed food. He revealed that carbohydrates constituted 48% of our diet, of which 12% was sugar free, with protein comprising 15% only. [19] However, the author did not discuss deficiencies in vitamins or trace elements secondary to consuming this diet. A large Australian study that recruited more than 12,000 participants also showed that 13% of total energy from the diet is supplied through ultra-processed food. In the USA and UK, this value has increased to 30% [20]. The lifestyle and eating habits chosen by people in developed countries has resulted in severe health problems. The fact that malnutrition can lead to degeneration of nerves is well known, with less emphasis on severe optic nerve damage. The eye is an ideal organ to carry out screening, as vessels and nerve structures can be directly visualized through the assessment of the retina and optic nerve.

In recent years, optical coherence tomography (OCT) and other diagnostic imaging have shown the utility of imaging biomarkers for the early diagnosis and management of retinal diseases. As an example, the choroid thickness shows the extent to which diabetes has progressed in the eye. The measurement of the nerve fiber layers also seems to be an important prospective measurement method from an interdisciplinary approach. The measurement of the nerve fiber thickness is used in MS patients to assess the disease and its algorithms are used for this purpose. Recent study revealed that vitamin B₁₂ deficiency in children is associated with a significant decrease in the nerve fiber layers [21]. Therefore, early screening of certain deficits should be rapidly established to detect and prevent these disorders.

Conclusions

In summary, we revealed the potential damaging effect of malnutrition and excessive consumption of Fast food on the optic nerve, leading to significant loss of vision especially in childhood and early adolescence. There is an obvious lack of social awareness about the negative impact of ultra-processed food consumption on the human body, including the eye. Screening for vitamin deficiencies should therefore be carried out if the underlying reason for visual impairment and optic neuropathy is unclear. Early detection and management in parallel with psychiatric and dietetic consultations are crucial to prevent possible consequences

and comorbidities of this disorder.

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