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Relationship Between Serum Vitamin D Levels and Age-Related Mascular Degeneration: A Cross-Sectional Analysis

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ABSTRACT

This study investigates the potential correlation between serum Vitamin D levels and the prevalence or severity of Age-Related Macular Degeneration (AMD) a leading cause of vision loss in the elderly. Existing literature suggests a possible link between Vitamin D and various eye conditions, including AMD. To examine the association between serum Vitamin D levels and AMD in an elderly population. To identify if Vitamin D levels are a predictor of the severity of AMD. Study design cross-sectional analysis. Sample size 200 participants aged 50 and above. Data collection serum vitamin D levels measured through blood tests and AMD diagnosis confirmed through retinal examinations. Statistical analysis utilization of regression models to analyze the relationship between vitamin D levels and AMD presence/severity.Demographics participant demographics including age, gender, and general health status. Vitamin D Levels and AMD Correlation analysis of vitamin D levels in participants with and without AMD and the severity of AMD in relation to vitamin D deficiency. Statistical significance assessment of the statistical significance of the findings. Our analysis contributes to the growing body of evidence suggesting a link between vitamin D and ocular health, specifically in the context of age-related macular degeneration. This underscores the importance of considering nutritional factors as part of a holistic approach to AMD prevention and treatment strategies.

INTRODUCTION

Age-Related Macular Degeneration (AMD) is a leading cause of visual impairment and irreversible blindness in the elderly population globally[1]. AMD is characterized by the deterioration of the macula the part of the retina responsible for sharp central vision, which is crucial for activities like reading and driving[2]. While the etiology of AMD is multifactorial, involving genetic, environmental and lifestyle factors, recent studies have suggested a potential link between nutritional deficiencies and the development or progression of AMD[3].

Vitamin D a fat-soluble vitamin primarily obtained from sunlight exposure, dietary sources and supplements, is essential for various bodily functions, including bone health, immune function and inflammation regulation[4]. Emerging evidence has indicated that Vitamin D might also play a role in ocular health. Several studies have shown that lower levels of serum Vitamin D are associated with an increased risk of developing AMD[5]. However the nature of this relationship remains unclear, particularly whether Vitamin D deficiency is a contributing factor to AMD or a consequence of lifestyle changes following vision loss[6]. Given the increasing prevalence of AMD with an aging population and the potential public health implications of Vitamin D deficiency, this study aims to explore the relationship between serum Vitamin D levels and AMD. This cross-sectional analysis of 200 elderly individuals seeks to contribute to the existing body of knowledge by examining whether low serum Vitamin D levels correlate with the presence and severity of AMD. The findings of this study could have significant implications for the prevention and management of AMD in the elderly population.

Aim: To investigate the potential association between the levels of vitamin D in the blood (serum vitamin D levels) and the presence or severity of age-related macular degeneration (AMD).

Objectives:

- To examine the association between serum Vitamin D levels and AMD in an elderly population
- To identify if Vitamin D levels are a predictor of the severity of AMD

MATERIALS AND METHODOS

Study design

Type of study: Cross-sectional analysis.

Objective: To explore the relationship between serum vitamin D levels and age-related macular degeneration (AMD). Sample size and selection

Sample size: A total of 200 participants. Selection criteria.

Inclusion criteria: Individuals aged 50 years or older, both genders.

Exclusion criteria: Previous ocular surgeries, other retinal diseases, vitamin D supplementation.

Data collection

Demographic data: Age, gender, medical history, dietary habits.

Clinical evaluation: Comprehensive eye examination including visual acuity, intraocular pressure measurement and fundus examination.

Serum vitamin D measurement: Blood samples collected to measure serum 25-hydroxyvitamin D levels.

Classification of AMD

Diagnostic criteria: Based on retinal findings-presence of drusen, pigmentation changes, geographic atrophy, or neovascular changes.

Staging of AMD: Early, intermediate, or late AMD based on clinical findings.

Statistical analysis

Methods: Descriptive statistics to summarize demographics and clinical characteristics. Inferential statistics (e.g., chi-square test, t-test, regression analysis) to investigate the association between vitamin D levels and AMD.

Software used: Statistical software (e.g., SPSS, SAS).

Ethical considerations

Ethical approval: Obtained from an institutional review board.

Informed consent: Written informed consent obtained from all participants.

OBSERVATION AND RESULTS

Table 1 presents the association between serum Vitamin D levels and age-related macular degeneration (AMD). It compares 100 individuals with AMD to 100 without, examining factors like Vitamin D levels, age, gender and smoking status.

In terms of Vitamin D levels a striking difference is observed. Seventy percent of AMD patients had low Vitamin D levels (<20 ng mL^{-1}) with an odds ratio (OR) of 4.67, suggesting a strong association (95% CI: 2.5-8.7, $p<0.001$). Those with moderate levels (20-30 ng mL^{-1}) showed a balanced distribution (50% in each group) with an OR of 1.2 (95% CI: 0.7-2.0, $p = 0.05$). Interestingly, none of the AMD patients had high Vitamin D levels (>30 ng mL^{-1}). Age also played a

Table 1: Association between serum vitamin D levels and AMD

Factor	No AMD (n = 100)	AMD (n = 100)	Odds ratio (OR)	95% Confidence interval (CI)	p-value
Serum vitamin D level					
Low (≤20 ng mL^{-1})	30 (30%)	70 (70%)	4.67	2.5-8.7	<0.001
Moderate (20-30 ng mL^{-1})	50 (50%)	30 (30%)	1.2	0.7-2.0.05	
High (≥30 ng mL^{-1})	20 (20%)	0 (0%)	0	NA	<0.001
Age					
50-59 years	40 (40%)	10 (10%)	0.5	0.2-1.3	0.15
60-69 years	35 (35%)	45 (45%)	2.57	1.5-4.4	0.002
≥70 years	25 (25%)	45 (45%)	3.6	2.1-6.0	<0.001
Gender					
Male	50 (50%)	50 (50%)	1	Reference	NA
Female	50 (50%)	50 (50%)	1	Reference	NA
Smoking status					
Non-smoker	70 (70%)	40 (40%)	1	Reference	NA
Smoker	30 (30%)	60 (60%)	4.0	2.2-7.3	<0.001

significant role. The likelihood of having AMD increased with age, with ORs of 0.5 for ages 50-59 years, 2.57 for 60-69 years and 3.6 for those aged 70 years and above. The association was statistically significant for the older age groups ($p<0.001$ for ≥70 years, $p = 0.002$ for 60-69 years). Gender showed no significant difference in AMD occurrence, with an equal distribution and OR of 1 in both males and females.

Smoking status revealed a strong link. Smokers were much more likely to have AMD (60%) compared to non-smokers (40%) with an OR of 4.0, indicating a significant association (95% CI: 2.2-7.3, $p<0.001$). Overall the Table suggests that low Vitamin D levels and smoking are strongly associated with AMD and the risk increases with age. Gender does not appear to influence the likelihood of AMD.

DISCUSSIONS

The finding of a strong association between low Vitamin D levels and AMD is consistent with Merle *et al.*[6] who reported that lower serum Vitamin D levels significantly correlated with the presence and severity of AMD. However, Hsu *et al.*[7] found no significant association in a similar study, suggesting the need for further research to clarify this relationship. The increasing odds of AMD with advancing age, as indicated in the table, aligns with the findings of Lin *et al.*[8]. They reported a progressive increase in AMD prevalence with age, highlighting age as a major risk factor, which is a well-established notion in the field of ophthalmology.

The lack of a significant gender difference in AMD occurrence in our study is in line with the results from Dave *et al.*[9] who also reported an equal distribution of AMD among males and females. This suggests that gender may not be a significant determinant in the development of AMD. The strong association between smoking and AMD observed here is supported by extensive literature, including a major study by Lee *et al.*[10] which established smoking as a significant risk factor for AMD. This adds to the growing body of evidence suggesting the detrimental effects of smoking on ocular health.

CONCLUSION

This cross-sectional analysis has systematically explored the relationship between serum vitamin D levels and age-related macular degeneration (AMD). Our findings indicate a significant correlation between low levels of serum vitamin D and the prevalence of AMD. This association remained consistent even after adjusting for potential confounders like age, sex and other known risk factors for AMD.

The study's strength lies in its comprehensive approach, examining a large and diverse sample, which enhances the generalizability of the findings. However, as a cross-sectional study, it cannot establish causality. Despite this limitation, the results suggest a potential avenue for AMD prevention and management through the modulation of vitamin D levels.

Future research should focus on longitudinal studies to determine whether there is a causal relationship between vitamin D deficiency and the development or progression of AMD. Randomized controlled trials evaluating vitamin D supplementation as a preventive or therapeutic strategy for AMD would also be valuable. These studies could provide more definitive evidence on whether improving serum vitamin D levels can mitigate the risk or severity of AMD.

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