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Therapeutic effect of lutein supplement on non-proliferative diabetic retinopathy

A retrospective study

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Abstract

This study retrospectively evaluated the effect of lutein supplement (LS) on patients with non-proliferative diabetic retinopathy (NPDR).

A total of 72 patients with NPDR were included in this study. All patients received Zeaxanthin during the study period. In addition, 36 patients also received LS and were assigned to the treatment group, while the other 36 patients did not receive LS and were assigned to the control group. All patients were treated for a total of 4 months. The endpoints included visual acuity (VA), contrast sensitivity (CS), and glare sensitivity (GS). In addition, any adverse events were also assessed. All endpoints were measured before and after 4-month treatment.

Before treatment, there were no significant differences in VA ($P = .75$), CS ($P = .71$), and GS ($P = .73$) between two groups. After 4-month treatment, there were still no significant differences in all endpoints of VA ($P = .66$), CS ($P = .58$), and GS ($P = .61$) between two groups. No adverse events were recorded in either group.

The results of this retrospective study showed that LS may not benefit for patients with NPDR after 4-month treatment. More high quality randomized controlled trials should still be needed to warrant the results of this study.

Abbreviations: CS = contrast sensitivity, DM = diabetic mellitus, DR = Diabetic retinopathy, GS = glare sensitivity, L/Z = Lutein and Zeaxanthin, LS = lutein supplement, NPDR = non-proliferative diabetic retinopathy, VA = visual acuity.

Keywords: effect, lutein supplement, non-proliferative diabetic retinopathy

1. Introduction

Diabetic retinopathy (DR) is a chronic metabolic retinal damage condition,[1–2] which is characterized by hyperglycemia due to the complications of diabetic mellitus (DM).[3–5] This condition is also a frequent and leading cause that accounts for the adult vision impairment and blindness, especially among the population between 20 and 60 years of age.[6] Previous studies have reported that DR accounted for 4.8% (1.8 million) cases for the whole 37 million blind people around the world in 2002.[6] Other studies also reported that the global prevalence of DR among different ethnic groups ranges widely from 20.8% in Asians to 46.7% in Caucasians.[7] Although a variety of managements are reported to treat this disorder, no permanent cure is still available.[8–15] Thus, effective therapies are needed to help in preventing and treating patients with DR to delay and to prevent its progression for visual function impairment.

Several previous studies have found that oxidative stress is involved in the pathogenesis of DM and its complications, especially for cataract and non-proliferative diabetic retinopathy (NPDR).[16–19] Zeaxanthin and lutein supplement (LS) are both reported to contain rich antioxidant properties.[20–23] Furthermore, several previous studies also reported to utilize LS for prevention and treatment of NPDR, and also achieved satisfied outcomes.[24–25] However, present evidence is still insufficient and more evidence is still needed to support this intervention. Thus, it is still necessary to investigate the effect of LS for patients with NPDR. In this retrospective study, we assessed the effect of LS for patients with NPDR.

2. Methods and patients

2.1. Ethic approval

This retrospective study was approved by the Ethical Committee of First Affiliated Hospital of Jiamusi University. The written informed consent was waived because this study just analyzed all endpoints data from completed medical records.

2.2. Design

This retrospective study was conducted from January 2016 to December 2017 at First Affiliated Hospital of Jiamusi University. We included 72 patients with NPDR in this study. Of these, 36 patients received Zeaxanthin and LS and were assigned to the treatment group, while the other 36 patients received Zeaxanthin alone and were assigned to the control group according to the

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The authors report no conflicts of interest.

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different treatments they received. Patients in both groups were treated for a total of 4 months. All efficacy endpoints were measured before and after 4-month treatment in this study. In this study, all researchers, patients, and outcome assessors were not blinded, except the data analyst.

2.3. Inclusion and exclusion criteria

This study included patients aged from 40 to 75 years old. All of them received complete ophthalmologic examination and were clinically diagnosed of type 2 DM with NPDR in mild or moderate phrase. However, patients were excluded if they had proliferated DR or other conditions except the NPDR. These conditions included type 1 DM, macular degeneration, diabetic macular edema, retinal detachment, glaucoma; or history of eye trauma, pregnancy, or breast feeding; or received other treatments for NPDP 1 month before this study; or receiving other therapies for NPDP during the period of study.

2.4. Treatment schedule

All 72 participants in both groups received Zeaxanthin 0.5 mg daily for a total of 4 months. In addition, 36 patients in the treatment group also received LS 6 mg daily for a total of 4 months, while the other 36 patients in the control group did not receive LS.

2.5. Endpoints measurement

The efficacy endpoints consisted of visual acuity (VA),[26] contrast sensitivity (CS),[27] and glare sensitivity (GS).[28] All these endpoints were measured before and after 4-month treatment. Additionally, any expected and unexpected adverse events were also assessed in this study.

2.6. Statistical analysis

All endpoints data were analyzed by a blinded statistician using SPSS Statistics 15.0 (IBM Corp., Armonk, NY, USA). Mann–Whitney test or Student's *t*-test were used to analyze the continuous endpoints data. Fisher's exact test was used to analyze the categorical endpoints data. The value of $P < .05$ is considered as having statistical significance.

Table 1

Characteristics comparison between two groups before the study.

Characteristics	Treatment group (n = 36)	Control group (n = 36)	*P* value
Age (year)	55.9 (10.1)	58.3 (10.8)	.33
Gender			
Male	24 (66.7)	27 (75.0)	.44
Female	12 (33.3)	9 (25.0)	–
Race (Chinese)	36 (100.0)	36 (100.0)	–
Weight (kg)	67.3 (9.7)	69.1 (10.2)	.44
BMI (kg/m^2)	24.7 (2.2)	25.0 (2.5)	.59
Waist circumstance (cm)	90.2 (10.4)	92.5 (11.1)	.36
Education background			
Primary school or below	5 (13.9)	7 (19.4)	.53
Secondary school	11 (30.6)	13 (36.1)	.62
High school	14 (38.9)	12 (33.3)	.62
College or high	6 (16.7)	4 (11.1)	.50
Family history of DM	4 (11.1)	6 (16.7)	.50
Smoking history	23 (63.9)	25 (69.4)	.62
Drinking history	20 (55.6)	17 (47.2)	.48
Blood pressure (mm Hg)			
Systolic	133.8 (13.1)	134.3 (14.4)	.88
Diastolic	82.9 (10.6)	83.7 (12.0)	.76

Data are present as mean ± standard deviation or number (%).
BMI = body mass index, DM = diabetic mellitus.

Table 2

Comparison of visual acuity between two groups.

Visual acuity	Treatment group (n = 36)	Control group (n = 36)	*P* value
Before treatment	0.37 (0.25)	0.35 (0.29)	.75
After treatment	0.44 (0.31)	0.39 (0.33)	.51
Change from prior-treatment	0.07 (0.02, 0.11)	0.04 (0.01, 0.08)	
Difference between two groups		0.03 (0.01, 0.05)	.66

Data are present as mean ± standard deviation or range.

Table 3

Comparison of contrast sensitivity between two groups.

Contrast sensitivity	Treatment group (n = 36)	Control group (n = 36)	*P* value
Before treatment	1.06 (0.22)	1.08 (0.24)	.71
After treatment	0.69 (0.34)	0.75 (0.37)	.47
Change from prior-treatment	−0.38 (−0.50, −0.24)	−0.33 (−0.42, −0.20)	
Difference between two groups		−0.06 (−0.09, −0.03)	.58

Data are present as mean ± standard deviation or range.

3. Results

The comparison of all characteristics between two groups before this study is showed in Table 1. There were not significant differences regarding all characteristic values between two groups prior to the treatment in this study (Table 1).

Before the treatment, no significant differences in all effect endpoints of VA ($P = .75$, Table 2), CS ($P = .71$, Table 3), and GS ($P = .73$, Table 4) were found between two groups.

After 4-month treatment, there were still no significant differences in VA ($P = .66$, Table 2), CS ($P = .58$, Table 3), and GS ($P = .61$, Table 4) between two groups.

After 4-month treatment, no adverse events were reported in either group in this study. No death related to the treatments was reported in either group.

4. Discussion

Previous studies have reported that NPDR are highly associated with oxidative stress.[16–19] Meanwhile, LS is found to contain

Table 4

Comparison of glare sensitivity between two groups.

Glare sensitivity	Treatment group (n = 36)	Control group (n = 36)	*P* value
Before treatment	0.99 (0.35)	1.02 (0.38)	.73
After treatetment	0.70 (0.31)	0.77 (0.33)	.35
Change from prior-treatment	−0.29 (−0.48, −0.17)	−0.25 (−0.40, −0.12)	
Difference between two groups		−0.05 (−0.08, −0.02)	.61

Data are present as mean ± standard deviation or range.

rich antioxidant properties.[20–23] In addition, two previous studies utilized it for preventing the mild or moderate NPDR, and also exerted a promising effect.[24–25] The results of the first study found that LS resulted in potential improvements in CS at low spatial frequency.[24] However, it only included 30 patients in this study. The other study compared the serum concentrations of Lutein and Zeaxanthin (L/Z) between patients with NPDR and normal participant. In addition, it also investigated the effect of L/Z supplementation on visual function in patients with NPDR.[25] Its results showed that L/Z can significantly lower the serum L/Z concentrations in NPDR patients, and also can enhance VA, CS, and macular edema.[25]

The present study compared the effect of Zeaxanthin and LS with Zeaxanthin alone for the prevention of patients with NPDR. Its results are not consistent with the previous studies.[24–25] The results of the present study demonstrated that after 4-month treatment, patients in the treatment group did not exert better effect endpoints in VA ($P = .66$), CS ($P = .58$), and GS ($P = .61$), than patients in the control group. The results indicated that LS may not benefit for patients with NPDR.

This study has several limitations. Firstly, although the sample size is much bigger than the previous study,[24] more large scale studies are still needed to warrant the results of this study. Second, this study did not apply procedures of randomization, masked to the patients and researchers, because all the data were collected from the completed medical records. Thus, it may cause higher risk of bias for patient selection. In addition, this study also did not apply blinding procedure to the outcome assessors, which may also bring higher risk of detection bias. Therefore, future studies should avoid those limitations.

5. Conclusion

The results of this study did not found that LS may be effective for patients with NPDR. More high quality studies with large scales are still needed to warrant the results of this study.

Author contributions

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