Impact of Self-Learning Nutrition Education on Improving Awareness and Knowledge of Age-Related Macular Degeneration, and the Role of Lutein/Zeaxanthin in Eye Health

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Abstract

Age-related macular degeneration (AMD) is a condition affecting older people and involves the irreversible loss of central vision. Studies shown that increased dietary intake of lutein/zeaxanthin (L/Z) is associated with a lower risk of AMD. The purposes of this study were to 1) develop a set of 2 self-learning nutrition education consists of an AMD video and a role of L/Z in eye health video. 2) study satisfaction with the set of 2 videos in adults and the elderly 3) Compare awareness and knowledge of AMD, and the role of L/Z in eye health before and after viewing each video. This study was conducted in a quasi-experimental design, setting in Bangkok, Thailand. A voluntary sample of 103 adults and the elderly aged between 50 and 75 was recruited during April – May 2018. Participants were asked to complete a pre-test which was a questionnaire for awareness and knowledge of AMD prior to viewing the AMD video, and to complete a pre-test questionnaire for the role of L/Z in eye health prior to viewing the role of L/Z in eye health video. After self-learning through each of video, participants were asked to complete a post-test which was the same questionnaire as the pre-test, and completed a satisfaction questionnaire for that video. The research instruments have been verified by 3 experts, having IOC value of 0.91. The reliability of instrument was tested using Cronbach's alpha coefficient, $\alpha = 0.879$. The data was analyzed by mean, S.D. and t-test. Results revealed that 1) Participants had an overall satisfactory score on both of AMD video and the role of L/Z in eye health video at extremely satisfied level ($\bar{x}$=4.60, S.D.=0.427 and $\bar{x}$=4.68, S.D.=0.429 respectively). 2) After the self-learning through the AMD video, participants showed a significantly higher score in their awareness and knowledge of AMD compared to their score before self-learning ($\bar{x}$=11.63, S.D.=2.347 and $\bar{x}$=3.78, S.D.=2.642 respectively) at $p<.05$ (t= 25.148, P-value= 0.000). 3) After the self-learning through the role of L/Z in eye health video, participants also showed a significantly higher score in their awareness and knowledge of the role of L/Z in eye health compared to their score before self-learning ($\bar{x}$=12.88, S.D.=9.474 and $\bar{x}$=5.10, S.D.=3.661 respectively) at $<.05$ (t= 8.190, P-value= 0.000). This can be concluded that the developed self-learning nutrition education were readily accepted by the adults and elderly. In addition, the self-learning intervention has shown a positive impact on improving awareness and knowledge of AMD, and the role of L/Z in eye health for adults and the elderly.

Keywords: Nutrition Education, Lutein/Zeaxanthin, Adults and the Elderly, Age-Related Macular Degeneration.

1. Introduction

Age-related macular degeneration (AMD) is a condition affecting older people and involves the loss of the person's central field of vision (World Health Organization [WHO], 2019). According to WHO (2019), AMD ranks third as a cause of blindness after cataracts and glaucoma, and it is the primary cause of blindness in industrialized countries. Regarding the 4th National Survey of Blindness, Low Vision and Major Eye Diseases in Thailand (2007), AMD also marked as the 3rd leading cause of blindness

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after cataracts and glaucoma, with approximately 799,296 Thai people suffering from AMD and 21,425 people having had irreversible blindness associated with AMD (Yenjit et al., 2007). The incidence of AMD is expected to rise with the aging of the population. While antivascular endothelial growth factor (anti-VEGF) therapy has been introduced for the wet form of the disease, a therapeutic regimen for the dry form, which affects the majority of AMD patients, is still lacking. Therefore, preventive strategies such as education to raise awareness and knowledge about AMD, emphasis on lifestyle changes that can impact the elderly's eye health are becoming prudent for policy makers and health care practitioners.

Lifestyle practices such as eating a healthy diet high in green leafy vegetables, eating fish high in omega-3 fatty acids, avoid smoking, maintaining normal blood pressure, cholesterol level as well as exercise regularly, can play a significant role in reducing the risk of developing AMD (National Eye institute, 2019). The two carotenoids, namely lutein and zeaxanthin (L/Z), which are antioxidants and only 2 carotenoids located in the eye retina, may protect against AMD (American Optometric Association [AOA], 2019). Numerous studies have identified L/Z to be essential components for eye health. One of the first large studies on carotenoids is the Eye Disease Case Control Study, in which diets were compared as the risk factors for developing AMD. Results revealed a significantly lower risk for developing AMD in people with high amounts of L/Z in their blood. Also, those people eating a diet with the most L/Z (as much as 5.8 milligrams (mg) per day) had a significantly lower risk for AMD than those whose diet contained the least amount (as low as 1.2 mg per day) (Seddon et al., 1994). In addition, dietary studies have confirmed the association between frequent consumption of spinach or collard greens, particularly good sources of L/Z, and a lower risk of AMD. An analysis of a national dietary study called the 3rd National Health and Nutrition Examination Survey (NHANES III) in the US showed that consuming 6 mg per day of dietary L/Z was associated with a reduced risk for developing AMD (Marse-Perlman et al., 2001; AOA, 2019)

L/Z are the most common carotenoids found in green leafy vegetables (e.g. kale, spinach, broccoli, peas and lettuce), egg yolks and corn (Abdel-Aal et al., 2013). Given the positive association between L/Z and AMD, it seems prudent for people to obtain higher amounts of these nutrients from their daily diet especially from green leafy vegetables. However, majority of populations especially Thai people are not consuming enough fruits and vegetables each day. According to the 5th Thai National Health Examination Survey (NHES V), almost half of the population are consuming less than 2 servings of vegetables each day. Furthermore, older adults tend to consume fewer vegetables than younger adults (HSRI, 2019). Although there is no recommended daily intake for L/Z for Thai people, the studies referenced here suggest an intake of 6 mg or more per day of dietary L/Z to decrease the risk of developing AMD (AOA, 2019).

Nutritional education is a process by which people are assisted in making decisions about eating. Its ultimate goals are to improve the recipients' nutritional status or other aspects of their nutritional well-being through both knowledge acquisition, and behavior change

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skills (FAO, 2019). According to Parker et al. (2011), the video educational delivery strategy was mostly preferred by older adults, especially those with limited income and they also reported that the video was more enjoyable and found the educational content more stimulating when compared to PowerPoint and handout educational delivery strategy. Therefore, researchers were interested in developing a set of nutrition education videos consisting of the AMD disease video and the role of L/Z nutrients in eye health video. These videos were aimed to improve awareness and knowledge about AMD, and emphasized the important role of L/Z in eye health for people at risk. The developed videos would be an efficient tool that can be incorporated into today health education programme for healthcare practitioners as well as community partners who responsible for health care prevention in adults and the elderly.

2. Methods

This research was conducted in a quasi-experimental design (one group pretest – posttest design). Participants were 103 adults and elderly, aged 50 – 75 years selected by voluntary participants who applied for this research during April – May 2018. Inclusion criteria are adults and the elderly ages 50 - 75, fluent in Thai language (listening/reading/writing), never attended education about AMD and the role of L/Z in eye health and completely sign the informed consent. Exclusion criteria are physical limitation that prevent the person following the instruction and the person who is not able to fully complete the experiment.

2.1 Research instruments:

2.1.1 The set of two self-learning nutrition education videos consist of the AMD video and the role of L/Z in eye health video. To develop self-learning nutrition education video for adults and the elderly, researchers synthesized knowledge from theories of Sahyoun et al. (2004) and Higgins & Barkley (2003) in relation to adult learning and nutrition education for older adults. In addition, researchers conducted an in-depth interview with an expert in elderly media and conducted a focus group discussion among 6 adults and elderly, aged 50-75, aimed at understanding their preference when it comes to nutrition education. The content demonstrated in the video was adjusted and verified by experts before we tested the video in 30 participants.

2.1.1.1 The AMD video is a 15-minute self-learning video (Figure 1-4). There was a modulator interviewed an ophthalmologist, discussing what people should know about

Figure (1): The modulator interviewed the ophthalmologist, discussing about what people should know regarding the disease namely AMD.

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AMD, what AMD is, who is at risk, how it is detected, the stages and treatment of AMD, and how the eye can be protected) from AMD.

Figure (2): Pictures show how the sight of someone with AMD can be affected
(ForeseeHome, 2019; Talley Eye Institute, 2019)

Figure (3): The ophthalmologist demonstrated how to detect AMD by one self at home.

Figure (4): AMD risk factors and lifestyle practice that can prevent AMD
(OneBite Wellness, 2019; Macula Center, 2019)

2.1.1.2 The role of L/Z in eye health video (Figure 5-13) is a 20-minute self- learning video. There was a modulator interviewed a nutritionist, discussing about what people should know about the role of nutrients in eye health, what L/Z is, why L/Z can prevent AMD, the recommended daily intake for L/Z, the dietary sources and suggested meal plans to get enough dietary L/Z. Researchers referred the amount of dietary L/Z found in foods which demonstrated in the videos from the USDA Food Composition Databases (2019). However, for particular Thai dishes, we referred to results of Busaba & Siriporn (2012). In order to make the video to be easy recognized for L/Z rich foods, researchers divided L/Z rich food into 5 groups including green leafy vegetables, legume/beans and nut, orange-red colored vegetables, grains and egg. Amount of L/Z, percentage of the

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recommended daily intake for L/Z and rating star for each item of L/Z rich food was

L/Z rich foods	Food Quantity	Amount of L/Z (mg)	%RDI for L/Z*	Rating star**
Group I: Green Leafy Vegetables				
Cooked Kale	1 ladle	7.6	130	6
Cooked Chinese Spinach	1 ladle	5.0	80	5
Cos (lettuce)	2 cups	1.5	25	1.5
Cooked Broccoli	2 ladles	1.2	20	1
Cooked Asparagus	2 ladles	0.9	15	1
Fresh Basil	20 leaves	0.6	10	0.5

described in table 1.

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Group II: Beans and Nuts				
Cooked Edamame Beans	1 cup	2.5	40	2.5
Cooked Green Peas	½ cup	2.2	35	2
Cooked Green Beans	2 ladles	0.8	15	1
Pistachio	½ cup	0.7	10	0.5
Group III: Orange-red colored vegetables				
Cooked Pumpkin	2 ladles	1.1	20	1
Fresh Chili	1 tbsp	0.8	15	1
Cooked Carrot	2 ladles	0.6	10	0.5
Chili Powder	1 tsp	0.4	6	0.5
Group IV: Grains				
Cooked Sweet Corn	2 ladles	1.1	20	1
Group V: Egg				
Boiled Egg	2 eggs	0.4	6	0.5

Table (1): Amount of dietary L/Z (mg.) found in each item of L/Z rich foods which were categorized into 5 groups.

*percentage of the suggested daily intake for L/Z (AOA, 2019)

**Star Rating for each item of food (consuming totally 6 stars/day, will reach 6 mg. or 100% of dietary L/Z suggested per day)

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Figure (5): The modulator interviewed the nutritionist, discussing about the role of nutrients in eye health.

Figure (6): Eating 2 ladles of cooked Chinese kale or Chinese spinach, may help to achieve 100% of dietary L/Z recommended per day.

Figure (7): 2 ladles of cooked broccoli or 2 cups of lettuce provide about 20-25% of dietary L/Z recommended per day.

Figure (8): 1 tablespoon of chili provide about 15% of dietary L/Z recommended per day.

Figure (9): 2 ladles of cooked corn or pumpkin provide about 20% of dietary L/Z recommended per day.

Figure (10): 2 ladles of cooked carrot provide about 10% of dietary L/Z recommended per day.

Figure (11): 1/2 cup of cooked green peas provide about 35% of dietary L/Z recommended per day.

Figure (12): A cup of cooked edamame beans provide about 40% of dietary L/Z recommended per day.

Figure (13): A boiled egg provides about 3-5% of dietary L/Z recommended per day.

2.1.2 A questionnaire to collect personal general information of participants, including gender, age, marriage status, educational background, occupation, health status and family history in relation to AMD.

2.1.3. A questionnaire to access satisfaction with the set of two self-learning nutrition education videos.

2.1.4. A questionnaire to access awareness and knowledge of AMD, and a questionnaire to access awareness and knowledge of the role of L/Z in eye health.

The questionnaire for awareness and knowledge of AMD comprised 15 questions, while the questionnaire for awareness and knowledge of the role of L/Z in eye health comprised 16 questions. All questionnaires were verified by 3 experts (an ophthalmologist, a nutritionist and an expert in elderly education media) having an IOC value of 0.91. The reliability of the instrument was tested on 30 adults and elderly in test group using Cronbach's alpha coefficient, $\alpha = 0.879$. The data was analyzed by mean, standard deviation and paired sample t-test.

2.2 Human research protection

This study was approved by the Kasetsart University research ethics committee, carried out in compliance with the international guidelines for human research protection as a declaration of Helsinki, the Belmont Report, CIOMS guideline, and international conference on harmonization in good clinical practice (ICH-GCP). The study code is KUREC-HS61/007. The approval number is COA61/029, with an approval expiry date of 1st April 2019. Participants in this study were counseled, explained the purpose of the study, signed the informed consent, and have the right to terminate the study whenever required without any impact. The study was conducted only on voluntary adults and elderly.

2.3 Data collection

2.3.1 The participant was asked to fill out the questionnaire about their personal information, filled out the pre-tests which were a questionnaire about awareness and knowledge of AMD, and a questionnaire about the role of L/Z in eye health prior to the self-learning.

2.3.2 Participants viewed the AMD video, then answered the post-test which was the same set of questions as pre-test and filled out a questionnaire for satisfaction towards this self-learning video.

2.3.3 Participants viewed the role of L/Z in eye health video, then answered the post-test which was the same set of questions as pre-test, and filled out a questionnaire for satisfaction towards this self-learning video.

2.4 Data analysis

Statistical significance was determined to be a level of .05, and analyzed the following data:

2.4.1 Personal information: data analyzed by descriptive statistics, mean and S.D.

2.4.2 Satisfaction towards the set of two self-learning videos, data analyzed by descriptive statistics, mean and S.D.

2.4.3 Comparison of the mean scores for awareness and knowledge of AMD, and the role of L/Z in eye health, between the score before and after viewing the self-learning videos,

data analyzed by paired-sample t-test.

3. Results

A total of 83% of the participants were female and 17% were male, 73% of participants were aged between 50-60 years, while 27% were aged between 61-75 years with an average age of 57 years. A total of 60% of participants are married, 65% of participants were under graduated. In addition, 12% of the participants reported on having a family member with AMD. After viewing the self-learning nutrition education videos, the participants found satisfaction in various aspects as described in table 1 & 2 at an extremely satisfied level. The results for satisfaction in various aspects were in line with the results for overall satisfaction. Participants also found an overall satisfaction towards the AMD video and the L/Z role in eye health video at an extremely satisfied level ($\overline{x}$=4.60, S.D.=0.427 and $\overline{x}$=4.68, S.D.=0.429 respectively). (Table 2, 3)

Satisfaction with the AMD video	Mean	S.D.	Satisfaction level
1. Easy understanding of the story	4.59	0.550	Extremely satisfied
2. Content matched to topic	4.61	0.528	Extremely satisfied
3. Clear illustrations matched to content	4.63	0.524	Extremely satisfied
4. Illustration helped to easily understand content	4.62	0.562	Extremely satisfied
5. Suitable sound	4.61	0.660	Extremely satisfied
6. Suitable and easy understandable language	4.73	0.469	Extremely satisfied
7. Suitable and clear easy reading font and font size	4.50	0.715	Extremely satisfied
8. Interesting story that enhanced engagement	4.53	0.607	Extremely satisfied
9. Suitable video length	4.53	0.623	Extremely satisfied
10. Video encouraged further learning	4.54	0.623	Extremely satisfied
11. The content was practical in daily life	4.66	0.552	Extremely satisfied
12. Overall satisfaction	4.60	0.427	Extremely satisfied

Satisfaction score: 5=extremely satisfied, 4=very satisfied, 3=moderately satisfied, 2=slightly satisfied, 1=not at all

Table (2): Satisfaction with various aspects of the AMD videos of the participants after viewing the self-learning video.

Satisfaction with the L/Z video	Mean	S.D.	Satisfaction level

1. Easy understanding of the story	4.66	0.552	Extremely satisfied
2. Content matched to topic	4.70	0.461	Extremely satisfied
3. Clear illustrations matched to content	4.71	0.478	Extremely satisfied
4. Illustrations helped to easily understand content	4.75	0.437	Extremely satisfied
5. Suitable sound	4.66	0.552	Extremely satisfied
6. Suitable and easy understandable language	4.74	0.484	Extremely satisfied
7. Suitable and clear easy reading font and font size	4.67	0.567	Extremely satisfied
8. Interesting story that enhanced engagement	4.62	0.579	Extremely satisfied
	4.56	0.605	Extremely satisfied
9. Suitable video length	4.65	0.555	Extremely satisfied
10. Video encouraged further learning	4.78	0.418	Extremely satisfied
11. The content was practical in daily life	4.68	0.429	Extremely satisfied
12. Overall satisfaction			

Satisfaction score: 5=extremely satisfied, 4=very satisfied, 3=moderately satisfied, 2=slightly satisfied, 1=not at all

Table (3): Satisfaction with various aspects of the role of L/Z in eye health videos of participants after viewing the self-learning video

Comparing awareness and knowledge of AMD before and after they underwent the self-learning AMD video, it was found that the mean score for awareness and knowledge of AMD of participants after they viewed the video ($\overline{X}$=11.63, S.D.=2.347) was significantly higher than the mean score for awareness and knowledge before the video (=3.78, S.D.= 2.642) at <.05 (t= 25.148, P-value = 0.000). (Table 4) Results after viewing the self-learning L/Z role in eye health video also demonstrated the same trend. Mean score for awareness and knowledge of the role of L/Z in eye health ($\overline{X}$=12.88, S.D. = 9.474) was significantly higher than the mean score for awareness and knowledge before viewing the video ($\overline{X}$=5.10, S.D. =3.661) at <.05 (t= 8.190, P-value =0.000) (Table 5)

	before		after		T-test	Diff	P-value
	$\overline{X}$	S.D.	$\overline{X}$	S.D.			
Mean score for awareness and knowledge of AMD	3.78	2.642	11.63	2.347	-25.148***	102	0.000

*** statistically significant at .001

Table (4). Comparing the mean score for awareness and knowledge of AMD of participants

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before and after they viewed the self-learning nutrition education video

	before		after		T-test	Diff	P-value
	$\overline{x}$	S.D.	$\overline{x}$	S.D.			
Mean score for awareness and knowledge of the role of L/Z in eye health	5.10	3.661	12.88	9.474	-8.190***	102	0.000

*** statistically significant at .001

Table (5): Comparing the mean score for awareness and knowledge of the role of L/Z in eye health of participants before and after they viewing the self-learning nutrition education video

4. Discussion

According to the results, after viewing the AMD video, participants had the highest satisfaction score on the language followed by the content and the illustrations. They found the language demonstrated in the video was suitable and easy understandable, the content was practical in daily life and the illustration were clear and match to content. Satisfaction results also revealed the same trend for the L/Z role in eye health video, participants had the highest satisfaction score on the content followed by the illustrations and the language. They found the content which demonstrated in the video was practical in daily life, the illustrations helped to easy understand content and the language was suitable and easy understandable. This is concluded that the developed videos were well acceptable by the adults and elderly.

For the comparison between awareness and knowledge of AMD, and the role of L/Z in eye health before and after viewing videos, results revealed that the mean score for awareness and knowledge of AMD and the role of L/Z in eye health of participants were significantly higher than the mean score for awareness and knowledge before the videos at <.05. Therefore, it could be inferred that the adults and elderly improved their awareness and knowledge of AMD and the role of L/Z in eye health after they underwent the self-learning intervention. The adults and elderly demonstrated a better understanding of AMD, the AMD risk factors, ways to detect AMD, the stages and treatment of AMD as well as the way to prevent AMD. Furthermore, the adults and elderly also learned about the importance role of nutrients in eye health, especially the role of L/Z in preventing AMD, the recommended daily intake for L/Z, rich source of AMD, and a suggested meal plan that would provide adequate dietary L/Z. Results of this study were consistent with the study of Suthanya et al. (2010) which demonstrated that the knowledge of cataract patients and their caregivers were significantly different after receiving video education compared with their knowledge prior to receiving the education (p<0.01). In addition, results of this study were in line with the study of Yanut et al. (2016) in individuals at risk of having stroke in northern Thailand communities. Individuals viewed a short (10.45 minutes) educational video about stroke, narrated in the appropriate northern dialect, the majority of them (80%) shown more knowledgeable about the risk

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factors and warning signs of strokes after viewing than prior to viewing the video.

5. Conclusion

The nutrition intervention has shown a positive impact on improving awareness and knowledge of AMD and the role of L/Z in eye health. Furthermore, the intervention was readily accepted by the adults and elderly. Furthermore, the intervention was readily accepted by the adults and elderly, which enhanced their engagement and further learning. Health care practitioners, along with health promotion providers, especially elderly health promotions, may find this self-learning nutrition education video as an effective tool which can be incorporated into their current education programs. This tool may be used in the hospital, health promotion centers, as well as health promotion units located in the community.

6. Acknowledgements

7. Conflicts of Interest

The authors declare no conflicts of interest.

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