

THE PROPORTION OF MYOPIA AND ITS ASSOCIATING FACTORS IN MEDICAL STUDENTS BATCH 2017 OF UNIVERSITY UDAYANA

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Abstract: Myopia is a common eye disorder and is also one of the leading causes of blindness worldwide. A person is said to be myopic when a person cannot see objects which are at a distant. Myopia happens when light falls in front of the retina. The presence of myopia is also associated with near work activities, environmental exposure and nutritional intake. This study will research the proportion of myopia and the correlation of the associating factors and myopia in medical students in University Udayana of batch 2017. This study is an analytic study using cross sectional method. Data is obtained by using The Sydney Myopia Questionnaire and it is given out to random medical students of batch 2017 which sample who met the inclusion and exclusion criteria. The proportion of myopia among medical students' batch 2017 of University Udayana is 70.6%. There is correlation between myopia and near work activities such as using mobile devices and reading. Environmental exposure in the terms of mainly staying indoors and outdoors. Nutritional intake in terms of consumption of fast food and vegetables have an impact on myopia. Myopia among medical students' batch 2017 of University Udayana shows 70.6% proportion rate. There is a correlation of myopia and near work activities, environmental exposure and nutritional intake.

Keywords: myopia, refraction, near work, environmental exposure, nutritional intake.

1. INTRODUCTION

Myopia which is generally known as 'near-sightedness' or 'short-sightedness' is an occurrence where the eyeball is longer than normal. This causes the image to fall in front of the retina instead of on the retina. People whom diagnosed with myopia struggle to see objects which are distant as compared to objects which are near.¹ There are three degrees of myopia which are low myopia, medium myopia and high myopia. According to the World Health Organization (WHO), low myopia is defined as a spherical refractive error of -0.50 D to -3.0D in either eye. Next is medium myopia which ranges from -3.1D to -6.0D. High myopia which is defined as a spherical refractive error of - 6.1D or greater in either eye.²

Other than the degree of myopia, another parameter of which myopia can be based on is the type of myopia. There are different types of myopia which can affect people differently, some of the known types of myopia are simple myopia, pseudomyopia, transient drug induced myopia, nocturnal myopia, pathological myopia and etc.³ For the purpose of this research, the focus will be on simple myopia and pathological myopia, since simple myopia and pathological myopia are common occurrences. More on simple myopia and pathological myopia will be further defined in this study.

The occurrence of myopia is alarming and it is known to be associated with near work activities, environmental exposure and nutritional intake which will be further elaborated in this study.⁴ University Udayana medical students batch 2017 is chosen as a target sample because their high load of studying and hectic lifestyle.

2. MATERIALS AND METHODS

This study is designed to be an analytical study with cross sectional method. This study plans to prove environmental exposure, near work activities and nutritional intake as the associating factors of myopia. To obtain data from sample a questionnaire will be used. The questionnaire that will be used is a modified version of The Sydney Myopia questionnaire.⁵ This questionnaire contains questions related to the student's type of diet, time spent doing near work activities, and time spent outdoors. The sample population will fulfil the inclusion and exclusion criteria. The study will involve only the batch of 2017 medical students from the University Udayana. Samples were taken from specific populations based on inclusion criteria and exclusion criteria. The inclusion criteria was students who agree to participate in the questionnaire. The exclusion criteria was students who disagree to participate in the questionnaire. Formula is used to obtain sample size.⁶ The sample size of this study will be 51 medical students of batch 2017 from the University Udayana. Data collected from the questionnaire will be statistically analysed using SPSS version 26. This research has received ethical eligibility permission from the Research Ethics Commission (KEP) of the Faculty of Medicine, Udayana University No: 1132/UN14.2.2VII.14/LT/2020.

3. RESULTS

The data of this study was collected in the month of June 2020 period. The total number of respondents were medical students' batch 2017 of the Faculty of Medicine, Udayana University based on the inclusion criteria and exclusion criteria were 51 people. The results of the research data obtained were then processed, and data analysis was carried out. The characteristics of the research subjects are presented in tabular form and given an explanation.

Characteristics of Respondents

From the results collected through the questionnaire, it shows that the respondents were predominately females with a frequency of 35 people (68.6%) and the remaining were males 16 (31.4%). The proportion of myopia was found in as many as 36 people (70.6%) Based on the data tabulated in SPSS Ver 26, the highest frequency of refractive error was at -0.50D to -3.0D for both left and right eye which is a low degree of myopia. As many as 19 (37.3%) people had refraction error of -0.50D to -3.0D for both eyes. The results of the research on the characteristics of the respondents can be seen further in table 1.

Table 1: Characteristics of Respondents

Socio – demographic	Frequency (no)	Percentage (%)
Gender		
Male	16	31,4
Female	35	68,6
Myopic		
Yes	36	70,6
No	15	29,4
Refraction error of left eye		
No vision problems	16	31,4
-0.50 D to -3.0 D	19	37,3
-3.1 D to -6.0 D	11	21,6
-6.1 D and above	5	9,8
Refraction error of right eye		
No vision problems	15	29,4
-0.50 D to -3.0 D	19	37,3
-3.1 D to -6.0 D	10	19,6
-6.1 D and above	7	13,7
Total	51	100

Characteristics of Near Work Activities

Near work activities are also studied, task such as watching TV, using a mobile device, playing video games and reading a book are tabulated in the Table 2 below. A high frequency of 19 (37.3) respondents of this study watches tv for less than one hour in a day. Moving on, there were more than half of the total number respondents which is 28 (54.9%) who spends more than 3 hours a day using their mobile devices. However strangely, a high frequency of respondents which is 24 (47.1%) did not play video games at all in a day. In contrast to that, a high frequency of respondents 19 (37.3%) chooses to spend more than 3 hours a day reading books.

Table 2: Characteristics of Near Work Activities

Near Work Activity	Frequency (no)	Percentage (%)
Duration of watching TV per day (hours)		
Not at all	15	29,4
Less than 1 hour	19	37,3
1 – 2 hours	13	25,5
3 hours and more	4	7,8
Duration of using mobile phone per day (hours)		
Not at all	0	0
Less than 1 hour	7	13,7
1 – 2 hours	16	31,4
3 hours and more	28	54,9
Duration of playing video games per day (hours)		
Not at all	24	47,1
Less than 1 hour	10	19,6
1 – 2 hour	11	21,6
3 hours and more	6	11,8
Duration of reading books per day (hours)		
Not at all	4	7,8
Less than 1 hour	13	25,5
1 – 2 hour	15	29,4
3 hours or more	19	37,3
Total	51	100

Characteristics of Environmental Exposure

The time spent indoor and outdoor of each respondent during their semester breaks at semester 4,5 and 6 are also recorded in this study. The results are tabulated in table 3 below. From the results, during semester 4 most respondents 20 (32.9%) choose to spend their time indoors with a minimal of 2 hours spent outdoor per day. While in semester 5, a high frequency of respondents 20 (32.9%) choose to spend their time both equally indoor and outdoor. During semester 6, most respondents 27 (52.9%) choose to spend their time indoor with only up to 2 hours of the day spent outdoors.

Table 3: Characteristics of Environmental Exposure

Semester	Frequency (no)	Percentage (%)
Break in semester 4		
Mainly indoors and occasionally spending up to 2 hours outdoors per day	20	39,2
Equal amounts of time indoors and outdoors	19	37,3
Mostly outdoors and occasionally spending up to 2 hours indoors per day	12	23,5
Break in semester 5		
Mainly indoors and occasionally spending up to 2 hours outdoors per day	16	31,4
Equal amounts of time indoors and outdoors	20	39,2
Mostly outdoors and occasionally spending up to 2 hours indoors per day	15	29,4

Break in semester 6		
Mainly indoors and occasionally spending up to 2 hours outdoors per day	27	52,9
Equal amounts of time indoors and outdoors	18	35,3
Mostly outdoors and occasionally spending up to 2 hours indoors per day	6	11,8
Total	51	100

Characteristics of Nutritional Intake

The daily intake of common foods such as bread, vegetables, fish, chicken, eggs, yogurt and fruit juice were also studied and is tabulated in table 4 below. The results show that 16 (31.4%) of respondents does not consume vegetables in a week and another 16 (13.4) only consumes vegetables 1 to 3 times per week. As for bread consumption a high number of respondents 35 (68.6%) only consumes bread 1 to 3 times per week. For 100% fruit juice a high number of respondents 30 (58.8%) consumes them 1 to 3 times per week. A high frequency of respondents 36 (70.6%) consumed cheese or yogurt only per week. As for protein consumption of chicken and fish a frequency of 31 (60.8%) respondents consumed them 4 to 6 times per week. Next, a number of 28 (54.9%) respondents consumed egg 1 to 3 times per week. As for fast food, 19 (37.3%) respondents consumes fast food every day.

Table 4: Characteristics of Nutritional Intake

Nutritional Intake	Frequency (orang)	Percentage (%)
Vegetables		
Never	16	31,4
About 1-3 per week	16	31,4
About 4-6 per week	8	15,7
Everyday	11	21,6
Bread		
Never	1	2,0
About 1-3 per week	35	68,6
About 4-6 per week	13	25,5
Everyday	2	3,9
100% Fruit Juice		
Never	11	21,6
About 1-3 per week	30	58,8
About 4-6 per week	6	11,8
Everyday	4	7,8
Cheese or Yogurt		
Never	12	23,5
About 1-3 per week	36	70,6
About 4-6 per week	3	5,9
Chicken or Fish		
Never	0	0
About 1-3 per week	12	23,5
About 4-6 per week	31	60,8
Everyday	8	15,7
Egg		
Never	1	2,0
About 1-3 per week	28	54,9
About 4-6 per week	18	35,3
Everyday	4	7,8
Fast Food		
Never	10	19,6
About 1-3 per week	12	23,5
About 4-6 per week	10	19,6
Everyday	19	37,3
Total	51	100

Correlation between Near Work Activities and Myopia

The relationship between near work activities and myopia can be seen in table 5 below.

Table 5: Correlation between Near Work Activities and Myopia

Near Work Activities	Myopic		Non-Myopic		Total		Value P
	f	%	f	%	f	%	
Duration of watching TV per day (hours)							
Not at all	13	86,7	2	13,3	15	100	0,122
Less than 1 hour	12	63,2	7	36,8	19	100	
1 – 2 hours	7	53,8	6	46,2	13	100	
3 hours and more	4	100	0	0	4	100	
Duration of using mobile phone per day (hours)							
Less than 1 hour	2	28,6	5	71,4	7	100	<0,05
1 – 2 hours	13	81,3	3	18,8	16	100	
3 hours and more	21	75	7	25	28	100	
Duration of playing video games per day (hours)							
Not at all	19	79,2	5	20,8	24	100	0,306
Less than 1 hour	5	50	5	50	10	100	
1 – 2 hours	7	63,6	4	36,4	11	100	
3 hours and more	5	83,3	1	16,7	6	100	
Duration of reading a book per day (hours)							
Not at all	2	50	2	50	4	100	<0,05
Less than 1 hour	7	53,8	6	46,2	13	100	
1 – 2 hours	9	60	6	40	15	100	
3 hours and more	18	94,7	1	5,3	19	100	

Based on Table 5 above, a majority of respondents 13 (86.7%) who are myopic and 2 (13.3%) respondents who are non-myopic stated to have not watch TV per day. By using the Chi – Square test the p value is 0.122 ($p>0.05$), this shows that there is not significance between watching TV and myopia.

As for using of mobile devices and the risk of developing myopia, there were 21 (75%) respondents who are myopic and 7 (25%) respondents who are non-myopic, they both use their mobile devices for 3 hours and more per day. Based on the Chi – Square test the p value is 0.029 ($p<0.05$), this shows that there is a significance between using a mobile device per day and the risk of developing myopia.

For playing video games and the risk of developing myopia, a total of 19 (79.2%) respondents who are myopic and 5 (20.8%) respondents who are non-myopic, of which both does not play video games at all per day. Using the Chi – Square test, the p value is 0.306 ($p>0.05$), this shows that there is no significance between playing video games and myopia.

For reading books and the risk of developing myopia, a total of 18 respondents (94.7%) who are myopic and 1(5.3%) respondent who is non myopic, both read books for more than 3 hours per day. Using the Chi – Square test, the p value is 0.033 ($p<0.05$), this shows that there is a significance between myopia and reading books.

Correlation between Environmental Exposure and Myopia

The relationship between environmental exposure such as spending time indoors and outdoors and its effect on the development of myopia is also studied. The results of the study are shown in table 6 below.

Table 6: Correlation between environmental exposure and myopia

Semester	Myopic		Non- Myopic		Total		Value P
	f	%	f	%	f	%	
Break in Semester 4							
Mainly indoors and occasionally spending up to 2 hours outdoors per day	17	85	3	15	20	100	<0,05
Equal amounts of time indoors and outdoors	14	73,7	5	26,3	19	100	

Mostly outdoors and occasionally spending up to 2 hours indoors per day	5	41,7	7	58,3	12	100	
Break in Semester 5							
Mainly indoors and occasionally spending up to 2 hours outdoors per day	12	75	4	25	16	100	
Equal amounts of time indoors and outdoors	17	85	3	15	20	100	<0,05
Mostly outdoors and occasionally spending up to 2 hours indoors per day	7	46,7	8	53,3	15	100	
Break in Semester 6							
Mainly indoors and occasionally spending up to 2 hours outdoors per day	23	85,2	4	14,8	27	100	
Equal amounts of time indoors and outdoors	9	50	9	50	18	100	<0,05
Mostly outdoors and occasionally spending up to 2 hours indoors per day	4	66,7	2	33,3	6	100	

Based on the table 6 above, during the break at semester 4, 17 (85%) respondent who are myopic and 3 (15%) respondents who are non-myopic spent their time mostly indoors during the break in semester 4 with an occasional time spent of 2 maximal outdoors. By using the Chi – Square test, the p value is 0.031 ($p < 0.05$), this shows that there is a significance between spending time indoors and myopia.

During the break in semester 5, 17 (85%) respondents who are myopic and 3 (15%) respondents who are non-myopic both spent equal time indoors and outdoors during the break. Based on the Chi- Square test, it is shown that the value of p is 0.043 ($p < 0.05$), which mean that there is a significance between spending time indoor and outdoor and the risk of developing myopia.

During the break in semester 6, a total of 23 (85.2%) respondents who are myopic and 4 (14.8%) who are non-myopic choose to spend their time indoors with an occasional outdoor exposure of maximum 2 hours. Based on the Chi- Square test, the p value is 0.039% ($p < 0.05$), this shows that there is a significance between spending time indoors and the risk of developing myopia.

Correlation between Nutritional Intake and Myopia

The nutritional intake of respondents is also studied to know if there is a relationship with food consumption and the risk of developing myopia. The results are shown in table 7 below.

Table 7: Correlation of Nutritional Intake and Myopia

Nutritional Intake	Myopic		Non – myopic		Total		Value P
	f	%	f	%	f	%	
Vegetables							
Never	13	81,3	3	18,8	16	100	<0,05
About 1-3 per week	14	87,5	2	12,5	16	100	
About 4-6 per week	4	50	4	50	8	100	
Everyday	5	45,5	6	54,5	11	100	
Bread							
Never	1	100	0	0	1	100	0,126
About 1-3 per week	27	77,1	8	22,9	35	100	
About 4-6 per week	6	46,2	7	53,8	13	100	
Everyday	2	100	0	0	2	100	
100% Fruit Juice							
Never	8	72,7	3	27,3	11	100	0,707
About 1-3 per week	22	73,3	8	26,7	30	100	
About 4-6 per week	3	50	3	50	6	100	
Everyday	3	75	1	25	4	100	
Cheese or Yogurt							
Never	11	91,7	1	8,3	12	100	0,089
About 1-3 per week	24	66,7	12	33,3	36	100	
About 4-6 per week	1	33,3	2	66,7	3	100	
Fish or Chicken							
About 1-3 per week	10	83,3	2	16,7	12	100	0,457

About 4-6 per week	20	64,5	11	35,5	31	100	
Everyday	6	75	2	25	8	100	
Egg							
Never	1	100	0	0	1	100	0,737
About 1-3 per week	20	71,4	8	28,6	28	100	
About 4-6 per week	13	72,2	5	27,8	18	100	
Everyday	2	50	2	50	4	100	
Fast Food							
Never	4	40	6	60	10	100	<0,05
About 1-3 per week	7	58,3	5	41,7	12	100	
About 4-6 per week	8	80	2	20	10	100	
Everyday	17	89,5	2	10,5	19	100	

Based on the results, 14 (85.7%) respondents are myopic while 2 (12.5%) respondents were non-myopic, both of which consumes vegetables 1-3 times per week. Based on the Chi- Square test, the p value is 0.045 ($p < 0.05$), which shows that there is a significance between consuming vegetables and myopia.

The p value of consumption of bread, 100% fruit juice, yogurt or cheese, fish or chicken and egg are 0.126, 0.707, 0.089, 0.457 and 0.737 respectively which shows there is no significance with myopia ($p > 0.05$).

As for the consumption of fast food and myopia, 17 (89.5%) respondents were myopic and 2 (10.5%) respondents non myopic both consumed fast food every day. Based on the chi square test, the p value is 0.028 ($p < 0.05$), which shows that there is a significance between consumption of fast food and myopia

4. DISCUSSION

General Overview

Majority of this research respondents are women. This research bear similarity to the result of a research that was made in Kupang, Indonesia whereby the majority of respondents in the study conducted about myopia were also female.⁷ Previous research stated there are no correlation or differences for either types of sex in regards to the proportion of myopia.⁸ The result that is obtained from this research agrees with other research which shows no inclination of a complaint regarding myopia to either male or female.⁹ Based on the complaints of short-sightedness/myopia, the dominant respondent complains with a refraction problem in which -0.50 D until -3.0 D on either right or the left eye. This result is indistinguishable from the result fruited from a research made by Hayatillah in year 2011 that shows dominant respondent (76,7%) medical students of UIN Syarif Hidayatullah that experience a range of -0.1D to -3.0 D myopia correction.

Near Work Activities

The result of this research regarding reading book which is done over a long period of time plus a high frequency of mobile phone usage nodded to the research made by Primadiani and Rahmi, in which, the respondents of the research produce a result with prolonged book reading being 60% and gadget usage being 80% with the amount of 14 respondents (22,2%) with myopia.¹⁰

Mobile phone usage in this research includes 54,9% respondents, these respondents stated they use mobile at least 3 hours or more per day. Mobile phone consists of many functions in which are internet access, media digital, phone calls and messages, it is common that mobile phone plays a major role in people everyday life, nevertheless for students who take parts in this research as respondents. Previous research which was done on students who were studying nursing courses indicates that they have a high frequency of mobile phone usage with the purpose of using its utilities such as searching information online and opening social media application, these respondents amount to 83%.⁷

This study has the results of 86.7% and 79.2 % of respondents who were myopic did not watch television and did not play video games. This statement agrees to a research where the medical students of Lampung University shows myopic respondents with low addiction towards video games.¹¹

Environmental exposure

Most of the myopic respondents from semester 4 and 6 shows high tendency in spending their time indoor while just spending at most 2 hours outdoor with a frequency of 85% and 85.2% respectively. Outdoor activities are exercises in which are done outside of the house or place which involves most things and not limited to sports or recreational entertainment.¹² In the other hand, indoor activities are things that can be done within the household where people can

read books, watching television, play video games and gadgets also indulge in checker games. Lately, the outdoor activities are recognized as one of the protective factors to myopia development. Based on the analysis which has been made from the result of this research indicates that people who spend their time outside longer has lower myopia tendency in comparison to people who spend their time indoor. Every hour spent outside of the property per week would decrease the risk of acquiring myopia by 2%.¹³ However, this is not beneficial for the participants in this study because they spend their time mostly indoors.

Nutritional Intake

Most of this research respondents have a habit of not consuming greens, they also do not eat vegetables as often every week, in which only consuming vegetables less than 3 times per week. Respondents also consume mainly on bread, 100% fruit juice, cheese or yogurt, and eggs which is consumed 1 – 3 times per week. On the other hand, fast food consumption is daily for the majority of the respondents. The result of this research mirrored the result of previous research which shows more than 50% of respondents admitted to consume less than 2 portion of greens per day.¹⁴ Other research produced different result with 63,3% of its respondents consume at least 2 vegetables every day.¹⁵

Eating habits such as breakfast can be influenced by several factors including, unavailability of other foods, foods which are unappetizing or repetitive meals which contributed to food selections.¹⁶ The high frequency of fast food consumption within students are caused by their own time management where a quick food preparation is important for them to catch up to their schedule to study. Research which is done by Lyo et.al made a statement that medical students has high affinity towards fast food, these students are also well-informed of its bad consequences towards their health, despite that, research still shows high frequency towards fast food consumption by medical students grasping 60,6% in number.¹⁷

Correlation of Near Work Activities and Myopia

The results of the chi square analysis in this study showed a significant relationship between reading, and mobile devices use with myopia (each $p < 0.05$). The results of this study are consistent with the research of Li et.al which shows a significant relationship in the form of book reading for a duration of longer than 45 minutes.¹⁸ The habit of reading for a prolonged time and until rested usually will involve posture adjustments to find their comfortable position. Some forms of adjustments posture involve tilting the head or reading while lying down on the bed with a close reading distance. Posture adjustment will increase dioptic stimulus, abnormal contraction of the extraocular muscles and an inability to focus on the retina which contributes to myopia.¹⁹

The research result evaluates the tendency of reading for a long time contributes to the development of myopia. The mechanism relates with the strength of the ciliary muscle of the eye which is used over time without pause, in which disrupts the ability to focus on far objects.²⁰ In addition to increased ciliary muscle tone, the lens of the eye can become more convex. Near work activities can cause the stretching mechanism to lengthen, which causes stretching of the sclera of the eye and leads to falling object images during close viewing that fall in front of the retina.²¹ Structural changes in the sclera can also occur in the choroid which causes axial elongation causing sharp visual disturbances.²²

The relationship between the duration of cell phone use and myopia in this study is in line with previous research which states that the duration of gadget use is related to eye fatigue which, if done prolonged, will have an impact on eye fatigue and a sharp decrease in vision.²³ The mechanism relates to the duration and distance looking at the screen. Staring at the gadget screen for a long time and at a close distance < 30 cm causes additional pressure on the eyes and nervous system, and low blinking frequency will cause excessive evaporation so that the eyes become dry. The water in the eye functions to improve sharp vision, clean the dirt that enters the eye through the air and is antibacterial. Lack of tears for a long time every day will cause the eyes to lack nutrients and oxygen, causing permanent disorders in the form of myopia.²⁴ Meanwhile, other studies show opposite results, where the intensity of cell phone use per day (hours) is not related to the visual function of medical students of Sam Ratulangi University, but the length of use in years has a significant relationship with complaints on the respondent's vision. This is related to the possibility of confounding variables in the form of unmeasured time lag in cell phone use per day.²⁵

The duration of watching TV and playing video games in this study did not show a significant relationship. Previous research has shown that respondents who suffer from myopia are significantly associated with high reading duration but low TV viewing duration.²⁶ Another study states that visual disturbances in the form of myopia occur when watching TV with a distance of < 3 m.¹⁸ In contrast to the research of You et al. who reported prolonged TV viewing was associated with refractive errors myopia.²⁷ On the other hand, Parssinen et al. mentioned watching TV with a duration of > 3 hours

shows a protective effect against myopia.²⁸ This suggests that the relationship between tv and myopia may be dependent on distance rather than duration. Other research states that there is a negative correlation between the level of fondness for playing video games and the learning achievement index.¹¹ The decrease in the learning achievement index of students has the potential to be one of the causes of the low duration of playing video games in this study. Playing video games is related to mood modification which aims to calm down, exude frustration or the problems that are being experienced.²⁹

Correlation between Environmental Exposure and Myopia

The results of the chi square analysis of this study showed a significant relationship between the tendency of indoor activities compared to outdoor activities to the incidence of myopia ($p < 0.05$). This result is in accordance with previous studies which obtained similar results, namely low outdoor activity which is described by sports activities in a week and hobby activities in a month increasing complaints of myopia. Outdoor activities that are rarely done in adolescence can cause an increase in myopia diopters by 0.15 times, while adolescents who routinely do outdoor activities can inhibit the increase in the degree of myopia by 17.5 times.³⁰

Outdoor activities generally have a higher light intensity than indoors, and the pupil will constrict more when outdoors. This will increase field acuity and release of dopamine by the retina due to light stimulation. The release of dopamine can act as an inhibitor for eye elongation. Meanwhile, indoor lighting that tends to be low will cause refractive errors in the eye.³¹

Another mechanism is the theory regarding vitamin D. Exposure to UVB radiation outdoors can stimulate the formation of vitamin D from pro vitamin D in the body. In the body, vitamin D plays a role in collagen synthesis as one of the main structures that make up the sclera.²² Previous research has suggested that emetropia associated with axial lengthening of the eye increases stretching of the ciliary muscles, zonula and lens, which has the potential to decrease the refractive force of the lens. If it lasts for a long period of time, the ciliary muscle will experience hypertrophy, thus inhibiting the flaking of the lens which aims to adjust the lengthening of the eyeball axis, causing myopia. Vitamin D which is formed in the body through the help of UVB can act as an antihypertrophic of the ciliary muscles, thereby reducing the progression of myopia.³²

Another study also states that violet light from the sun (VL 360-400nm wavelength) is able to slow down the progression of myopia, this theory was studied using chicks which proved that chicks exposed to violet light did not develop refractive errors towards myopia as compared to chicks exposed to blue light which developed myopia. This study also proved that children using violet light transmitting eyeglasses had a shorter axial length as compared to children using non-violet light transmitting eyeglasses.¹³

The results of this study contradict research by Lu et al. which states there is no relationship between outdoor activities and the incidence of myopia. This may be due to differences in respondent race, geographic location, which affects the intensity of outdoor activities and sunlight.³³

Correlation between Nutritional Intake and Myopia

The results of the chi square analysis of this study showed a significant relationship between vegetable consumption and the incidence of myopia ($p < 0.05$). Where the low level of consumption in this study is associated with high myopia complaints. This study also found a significant relationship between consumption of fast food and complaints of myopia. The relationship shows the consumption of fast food regularly to the high complaints of myopia among respondents. Previous research by Thomas et al. which states that high carbohydrate diets and low consumption of protein, fruit and vegetables are at risk of being one of the causes of low vision sharpness.³⁴

Vegetables contain various vitamins and minerals as well as active ingredients that are protective against the eyes such as carotenoids. Lutein and carotenoid compounds selectively cause the accumulation of macular pigments which play a role in increasing the sensitivity and contrast associated with visual acuity.³⁵ Clinical trial research shows that carotenoid supplementation can improve visual acuity in patients with degenerative diseases of the eye or healthy eyes.³⁵

Consumption of vegetables also acts as an antioxidant that can reduce oxidative stress thereby reducing damage to the retina and eye muscles.³⁶ Lutein and carotenoid supplementation also showed a sharp improvement in vision by increasing the efficiency of signaling in the eye nerves.³⁷

Research conducted by Lim et al. stated that the high consumption of fatty foods can increase the axial lengthening of the eye.³⁸ The axial lengthening of the eye can cause the progression of myopia to worsen.³⁹

Research Limitations

The limitation of this study is that information about near work activities only measures the duration and the measuring of the distance of the near work activities the respondent involved is not taken, in which it is unable to evaluate the effect of near work activities to myopia in more detail. This research use questionnaire which is very dependent of the honesty of the respondent to bear a correct yet accurate result. This research involves a specific population group which is the medical students' batch 2017 of University Udayana, in which the result cannot be applied to the general population.

5. CONCLUSION

Based on the result of the research that has been done, it can be concluded in points as follows:

1. Respondents in this study were predominantly female, with a proportion of myopia reaching 70.6%, and complaining of refractive errors -0.50 D to -3.0 D in both the left eye and the right eye.
2. There is a correlation between near work activities and myopia especially using mobile devices and reading.
3. There is a correlation between indoor and outdoor activities during the holidays and myopia. Also, there is an influence between more time spent indoors compared to outdoors on the incidence of myopia.
4. There is a correlation between eating habits and myopia where there is an influence between consumption of vegetables and consumption of fast food on the incidence of myopia ($p < 0.05$)

6. RECOMMENDATION

Based on the result of the research that has been done, suggestions can be made as follows:

1. It is necessary to do further analytic research related to the distance in the activity variable which is close to the distance and the strong relationship that is formed with myopia.
2. It is necessary to increase the number of samples so that the research becomes more representative.

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