



## Association of Axial Length and Myopia Degree: A Retrospective Study

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### ABSTRACT

**Introduction:** Myopia is a clinical condition that occurs when the image of a distant object is focused in front of the retina by the non-accommodating eye. The prevalence of Myopia has been getting higher for decades. A cohort study stated continuing axial elongation in adults with high Myopia. **Methods:** This research is a retrospective study approach. Data obtained from central general hospital Dr. Mohammad Hoesin Palembang from January 2021 to February 2022. Medical record data included in this study were patients diagnosed as myopic patients. The exclusion criteria were patients with missing medical records and any other refractive disorder. The correlation between myopia degree and axial length using ANOVA or Kruskal-Wallis H test depend on its data distribution. Data processing was performed using SPSS version 25. This study aims to determine the association between axial length and myopia degree. **Results:** Female patients are found predominantly (58.5%). Through the recent surveys, either the domestic or foreign population, results have stated that the prevalence of Myopia is higher in females, and other studies found that it fluctuated with age among adolescent females. The age of patients varies from 16 years to 75 years, and the mean baseline is  $30.9 \pm 3.82$  years. Mild Myopia accounts most common incidence (53.1%), with laterality, which is found to be more common in the left eye (57.1%). Mean baseline axial length  $21.95 \pm 2.85$  with visual acuity in LogMar  $0.89 \pm 0.51$ . There is a statistically significant difference in axial length based on myopia degree ( $p=0.000$ ). **Conclusion:** Female patients are found predominantly in myopia patients, with the age of patients varying from 16 years to 75 years and a mean baseline of  $30.9 \pm 3.82$  years. There is a statistically significant difference in axial length based on myopia degree.

### 1. Introduction

Myopia or nearsightedness is a clinical condition that occurs when the image of a distant object is focused in front of the retina by the non-accommodating eye.<sup>1,2</sup>

Myopia in East Asia has a high prevalence which contributes to 80-90% of the young adult population and becomes the leading cause of blindness.<sup>3</sup> In Taiwan and Singapore, the prevalence of Myopia is approximately 20-30% among children aged 6-7 years, as high as 84% among high school students in Taiwan.<sup>4,5</sup> In the United States, the myopia prevalence is 4.5 in ages 6-7 years and 28% at 12 years in a

predominantly white population.<sup>6</sup> In another study, Asians had the highest prevalence (18.5%) followed by Hispanics (13.2%) at 5-17 years children. African Americans (6.6%) and whites (4.4%) had the lowest prevalence.<sup>7</sup>

The myopia patients may have a longer anteroposterior axis of the globe or stronger refractive power than any other conditions.<sup>1,2</sup> Historical data suggested that along with childhood, axial length may be growth 0.1 mm per 6 months.<sup>8</sup> An analysis study of average axial change in the European population found the various axial length depends on age, with greater progression in under 9 years.<sup>9</sup> A cohort study

from Du et al. stated continuing axial elongation in adults with high Myopia.<sup>10</sup>

This study aims to determine the association between axial length and myopia degree in myopia patients at Dr. Mohammad Hoesin Palembang.

## 2. Methods

This research is a retrospective study approach to determine the association between axial length and myopia degree. Data obtained from the medical records of patients who were registered as myopic patients in the patient register at the ophthalmology polyclinic, central general hospital dr. Mohammad Hoesin Palembang, data was collected from the patient register book recorded from January 2021 to February 2022.

Medical record data included in this study were patients diagnosed as myopic patients. The exclusion criteria were patients with missing medical records and any other refractive disorder. The data studied included baseline data, including gender. The clinical

variables such as axial length, visual acuity using LogMar, and myopia degree. Relationships among baseline characteristics and axial length were evaluated using ANOVA or Chi-Square test. The correlation between myopia degree and axial length using ANOVA or Kruskal-Wallis H test depend on its data distribution. Data processing was performed using SPSS version 25.

## 3. Results

### Baseline characteristics of myopia patients

During the period from January 2021 to February 2022, there were 49 eyes from 29 patients included in this study based on inclusion and exclusion criteria. The demographic data include gender and age.

In this study, the number of myopic patients was slightly more in female patients (58.5%), with a ratio of 1:1.4 between males and females. The age of patients varies from 16 years to 75 years, and the mean baseline is 30.9± 3.82 years, as seen in Table 1.

Table 1. Baseline characteristics of myopia patients

Variable	n	%
Age (mean± SD)	30.9± 3.82	
Gender (n, %)		
Male	12	41.4
Female	17	58.6

### Clinical characteristics of myopia patients at Dr. Mohammad Hosein General Hospital Palembang

In this study, Myopia is divided into three groups include mild, moderate, and high Myopia. Mild Myopia

accounts most common incidence (53.1%), with laterality found to be more common in the left eye (57.1%). Mean baseline axial length 21.95± 2.85 mm with visual acuity in LogMar 0.89 ± 0.51.

Table 2. Clinical characteristics of myopia patients

Variable	n	%
Myopia	26	53.1
Mild Myopia	11	22.4
Moderate Myopia	12	24.5
High Myopia		
Laterality		
Right Eye	21	42.9
Left Eye	28	57.1
Axial length	21.95± 2.85	
Visual Acuity (LogMar)	0.89 ± 0.51	

Table 3. Association axial length and myopia degree of myopia patients

Variable	Axial length (mean ± SD)	p
Mild Myopia	19.75± 1.02	0.000
Moderate Myopia	23.02 ± 0.67	
High Myopia	25.72 ± 2.16	

\*Kruskal-Wallis H test

The homogeneity test was carried out with Levene's test showing the variance of the three groups was non-homogeneous ( $p=0.072$ ), then to determine the association of axial length and myopia degree of myopia patients using the Kruskal-Wallis H test. Based on the analysis of the Kruskal-Wallis H test, there is a statistically significant difference in axial length based on myopia degree ( $p=0.000$ ).

#### 4. Discussion

In this study, female patients are found predominantly (58.5%). Through the recent surveys, either the domestic or foreign population, results have stated that the prevalence of Myopia is higher in females, and other studies found that it fluctuated with age among adolescent females.<sup>11,12</sup> Recent study by Gong et al. stated that in young females with Myopia, the spherical lens showed a difference in all different times of the menstrual cycle ( $p<0.0001$ ), which hypothesized relevant factors of estrogen changes in Myopia, especially in their study.<sup>13</sup>

The age of patients varies from 16 years to 75 years, and the mean baseline is  $30.9 \pm 3.82$  years. Myopia in East Asia has a high prevalence which contributes 80-90% of the young adult population and becomes the leading cause of blindness.<sup>3</sup> In Europe, myopia prevalence increased in a lesser proportion, and surprisingly it has been a higher proportion in younger adults.<sup>14</sup> One possible reason for this phenomenon is near-work activities, such as reading, writing, or computer use, which are higher by decades, besides other factors such as parental Myopia, socioeconomic status, or outdoor activity.<sup>15</sup>

Mild Myopia accounts most common incidence (53.1%), with laterality, which is found to be more common in the left eye (57.1%) but not clearly significant. Mean baseline axial length  $21.95 \pm 2.85$

mm with visual acuity in logMar  $0.89 \pm 0.51$ . This finding is quite similar to a study from Yotsukura et al. in which the mean axial length was  $22.98 \pm 0.87$  mm.<sup>16</sup> Historical data suggested that along with childhood, axial length may be growth 0.1 mm per 6 months.<sup>8</sup> An analysis study of average axial change in the European population found the various axial length depend on age, with greater progression in those under 9 years.<sup>9</sup>

There is a statistically significant difference in axial length based on myopia degree. A cohort study from Du et al. stated continuing axial elongation in adults with high Myopia. Among 1877 patients with 9161 visits included in the analysis, the mean (SD) axial length was 29.66 (2.20) mm with a mean (SD) growth rate of 0.005 (0.24) mm/year in elderly patients.<sup>10</sup> Lee et al. from a 4-year longitudinal stated that the rates of AL change in high myopia and control groups were 0.047 and 0.011 mm/year, respectively. Subgroup 1 ( $\geq 27.5$  mm) and subgroup 2 (26.0-27.5 mm), which are the high myopia subgroups, showed a big increase in the AL over time, but subgroup 3 (24.5 -26.0 mm) and subgroup (<24.5 mm) did not show a significant change. The rate of AL in subgroup 1 was 0.064 mm/year, which was statistically significant ( $p<0.001$ ).<sup>17</sup>

This study has limitations consists a small sample size and its retrospective design. The longitudinal design may provide original data on the progression of Myopia and axial length. Future study needs to analyze the risk factors of myopia in an individual sample.

#### 5. Conclusion

Female patients are found predominantly in myopia patients, with the age of patients varying from 15 years to 75 years and a mean baseline of  $30.9 \pm 3.82$

years. There is a statistically significant difference in axial length based on myopia degree.

## 6. References

1. Rosenfield M. Refractive status of the eye. In Boris's Clinical Refraction 2<sup>nd</sup> eds. Missouri: Elsevier Inc. 2006; 93-138: 3-12
2. Sergienko NM, Nikonenko DP. Measurement of amplitude of accommodation in young persons. *Clin Exp Optom*. 2015.
3. Wu PC, Huang HM, Yu HJ, Fang PC, Chen CT. Epidemiology of Myopia. *Asia-Pacific J Ophth*. 2016; 5(6): 386-93.
4. Lin LL, Shih YF, Hsiao CK. Epidemiologic study of prevalence and severity of Myopia among school children in Taiwan in 2000. *K Formos Med Assoc*. 2001; 100: 684-91.
5. Saw SM, Carkeet A, Chia KS. Component dependent risk factors for ocular parameters in Singapore Chinese children. *Ophthalmology*. 2002; 109: 2065-71.
6. Klenstein RN, Jones LA, Hullet S. Refractive error and ethnicity in children. *Arch Ophthalmol*. 2003; 121: 1141-7.
7. Maul E, Barrisi S, Munoz SR. Refractive error study in Children: results from La Florida. Chile. *Am J Ophthalmol*. 2000; 129: 445-54.
8. Hou W, Norton TT, Hyman L, Gwiazda J, Group C. Axial elongation in myopic children and its association with myopia progression in the correction of myopia evaluation trial. *Eye Contact Lens*. 2018; 44(4): 248-59.
9. Tideman JW, Polling JR, Vingerling JR, Jaddoe VW, Williams C, et al. Axial length growth and the risk of developing Myopia in European Children. *Acta Ophthalmol*. 2018; 96(3): 301-9.
10. Du R, Xie S, Igarashi-Yokoi T. Continued increase of axial length and its risk factors in adults with high Myopia. *JAMA Ophthalmol*. 2021; 139(10): 1096-103.
11. Vitale S, Sperduto RD, Ferris FL, 3<sup>rd</sup> increased prevalence of Myopia in the United States between 1971-1972 and 1999-2004. *Arch Ophthalmol*. 2009; 127: 1632-9.
12. Wong TY, Foster PJ, Hee J, Ng TP, Tielsch JM, et al. Prevalence and risk factors for refractive errors in adult Chinese in Singapore. *Invest Ophthalmol Vis Sci*. 2000; 41: 2486-94.
13. Gong J. Relevant factors of estrogen changes of Myopia in adolescent females. *Chinese Med J*. 2015; 659-63.
14. Rudnicka AR, Kapetanakis VV, Wathern AK, et al. Global variations and time trends in the prevalence of childhood myopia, a systematic review and quantitative meta-analysis: implications for aetiology and early prevention. *Br J Ophthalmol* 2016; 100: 882-90.
15. Foster PJ, Jiang Y. Epidemiology of Myopia. *Eye (Lond)*. 2014: 202-8.
16. Yotsukura E. Myopia among school children the equatorial region of Brazil. *J Clin Med*. 2021.
17. Lee MW, Lee SE, Lim HB, Kim JY. Longitudinal changes in axial length in high Myopia: a 4- year prospective study. *Br J Ophthalmol*. 2020; 104: 600-3.