# Parental myopic status and its relation to early onset myopia in children and adolescent in Bali

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## ABSTRACT

**Introduction and Objectives:** Environmental and parental myopia were shown to be associated with the risk of myopia. Genetic factors may have a greater contribution to early development and degree of refractive error, but some studies also indicate the role of visual behaviors. This study was aimed to compare the proportion of myopic subjects, onset of myopia, myopic degree according to their myopic parental status and contribution of children habit.

**Methods:** This study is a cross sectional design involving subjects aged 12-25 years old in Bali, using google form questionnaire. Onset and degree of myopia were summarized based on parental myopic status on a chi-square crosstabulation. Multivariate analyses were conducted to assess factors that may associate to myopia such as sex, gadget and reading spending hour.

**Result:** From 444 samples eligible proportion of myopic subjects (62.5%) that has myopic parents was higher compared to non-myopic parents (p<0.001). Among all subjects that have genetic predisposition from both parents, the presentation of early-onset myopia were significantly higher (54.7%) compared to late-onset and no myopia (p<0.001). Although proportion of subjects that has moderate to high myopia was higher in myopic parent (61%) compared to subjects with no myopic parent (39%), the difference was not significant (p=0.822). Multivariate analysis showed that parental myopic status has strongest relation toward myopic status (p<0.01) followed by gadget spending hour, female, and reading spending hour.

**Conclusion :** Parental myopic status was the most important factor associated with early onset myopia, with smaller contributions from sex, reading spending hours and gadget spending hours.

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## INTRODUCTION

According to the World Health Organization report, uncorrected or under-corrected myopia is a major cause of visual impairment, and the cost of myopia corrections is very high compared with personal and family resources.[1] Despite the great impose of health burden,the exact cause of myopia is remained unclear. There has been a continuing debate over whether myopia is environmentally determined or is inherited and the theory about both environmental and genetic factors contribute to the development of myopia is widely acknowledged recently. Previous research has revealed that parental myopic status,[1,2] and female sex were at a higher risk of myopia.[1] Another study showed that children habit such as continuous reading(>45min)[3] play a significant role. Therefore this study was aimed to compare proportion of myopic subjects and onset of myopia, according to their parental myopic status and contribution of children habit. This study is a cross sectional design involving subjects aged 12-25 years old in Bali province.

## METHOD

Study was initiated after obtaining the approval and clearance from the institutional ethics committee and with the written consent from all the study participants. A total of 444 students (199 myopic and 243 non-myopic subjects) participated in the study, the age ranging from 12-25 years old. Subjects with the history of surgeries for refractive error correction, neurological complaints, long-term medical treatments, and pathological ocular disorders were excluded. The subjects were grouped into genetically predisposed (with either of the parent or both parents myopic) and genetically non-predisposed (both parents non-myopic). The data regarding the age of onset, family history and the refractory power at the present time were collected by 20 items self-filled questionnaire. Onset of myopia less than 14 years old were categorized as early onset. Subsequently the data were compiled and categorized based on genetic predisposition and myopic status (myopic and non-myopic). Chi-square test was used to do the analysis. P ≤ 0.05

was taken as the level of significance. Groups of myopic students according to their onset of myopia and relation to genetic predisposition also been analyzed. Multivariate analyses were conducted to assess possible confounding factors that may associate such as sex, parental myopic status, reading spending hours and gadget spending hours. SPSS Version 16.0 was used.

## RESULTS

Among 444 subjects involved, there was higher percentage of female (55%) compared to male participants. Among those, we found that proportion of myopic participant was 41.3%. Approximately 43.2% of subjects have myopic parents (either one or both parents). Data regarding daily activity showed that there was a higher percentage (82.2%) of subjects spending less than 4 hour in reading. Gadget spending hour less than 5 hours were in higher proportion compared to more than 5 hours a day. (**Table.1**)

Data showed percentage of myopic female were slightly higher (50.2%) than non-myopic female. In male groups there were higher proportion of non-myopic subjects (62.7%) compared to myopic male. This proportion was statistically significant (p=0.007), as shown in **Table 2**. In subjects that has either one parent with myopia, there were higher proportion of myopic subjects (56.5%). In subjects that both parents were myopia, there were also higher proportion (58.2%) of myopic subjects compared to non-myopic. There were higher proportions of non-myopic subjects (65.5%)

among those whose parents were both emetropia.

Among all subjects that spend less than 4 hours a day to read, there was lower proportion (42.5%) of myopia compared to non-myopia. Among subjects that spend more than 4 hours to read, proportion of myopic subjects were higher (57.7%). This proportion was statistically significant (p=0.049). Among all subjects that spend less than 5 hours contact with gadget, there were higher proportion of non-myopic subjects (59.7%). Among all subject that spend more than 5 hours using gadget, the proportion of myopic subjects were higher (54.4%). This proportion was also statistically significant (p=0.005).

Further analysis comparing myopia based on age of onset and parental myopic status (**Table 3**). Among those who has either one myopic parent, there were higher proportion of early-onset myopia (48.1%) compared to late (8.4%) and non-myopic proportion (43.5%). Data were also showed higher proportion of early-onset myopia (54.7%) in subjects that both parents were myopic. Proportion of late-onset myopia and non-myopia were lower (20.3% and 25%). Among those subjects that neither one of their parents has myopia, proportion of non-myopic subjects were higher (64.2%) compared to late onset (4.4%) and early onset myopia (31.4%). The proportion were all statistically significant (p<0.001).

Multivariate analysis showed that parental myopic status has strongest relation toward myopic status (p<0.01) followed by gadget spending hour, female sex, reading spending hour. (**Table 4**)

## DISCUSSION

In this study, there was higher proportion of myopic female compared to non-myopic female. This result consistent with previous study conducted in China. Guo,L et.al found that girls were at a higher risk of myopia than boys (adjusted odds ratio=1.22, 95% CI=1.04–1.44).[1]

This study showed that there were greater proportion of myopic subjects that has myopic parents, either one parents or both parents myopic. This finding also supported by research conducted by Chua SY et.al in china. Chua et.al found that in multivariable regression models compared to children whose parents were not myopic, those with two myopic parents were more likely to have a more myopic spherical equivalent (SE) (regression coefficient: 0.36; 95% confidence interval [CI]: 0.61 to 0.11) and longer AL (regression coefficient: 0.24; 95% CI: 0.10–0.39) and more likely to have myopia (odds ratio [OR] ¼ 4.8; 95% CI: 1.4–16.6).[2] In contrary to significant relation of genetic

## Table 1. Demographic Data of Subjects

| Variables | | Freq. | |
|---|---|---|---|
| | | **n** | **%** |
| Age | 12-14yo | 86 | 19.3 |
| | 14-16 yo | 73 | 16.4 |
| | 16-18 yo | 75 | 16.8 |
| | 18-20 yo | 83 | 18.6 |
| | 20-22 yo | 77 | 17.3 |
| | 22-25 yo | 50 | 11.2 |
| Sex | Female | 267 | 55.2 |
| | Male | 177 | 36.6 |
| Myopic status | Myopic | 200 | 41.3 |
| | Non-myopic | 244 | 51.4 |
| Parental myopic status | Myopic parent | 209 | 43.2 |
| | None | 234 | 48.3 |
| Reading spending hour | Less than 4 hours | 398 | 82.2 |
| | More than 4 hours | 46 | 9.5 |
| Gadget spending hour | Less than 5 hours | 295 | 61.0 |
| | More than 5 hours | 149 | 30.8 |

**Table 2. X test and Prevalence Ratio**

| Variables | | Myopic | | Non myopic | | PR | CI (95%) | | p |
|---|---|---|---|---|---|---|---|---|---|
| | | N | % | n | % | | min | max | |
| Sex | Female | 134 | 50.2 | 133 | 49.8 | 1.694 | 1.150 | 2.497 | 0.007 |
| | Male | 66 | 37.3 | 111 | 62.7 | | | | |
| Parental myopic status | Either one | 87 | 56.5 | 67 | 43.5 | - | - | - | - |
| | Both parents | 32 | 58.2 | 23 | 41.8 | | | | |
| | None | 81 | 34.5 | 154 | 65.5 | | | | |
| Reading spending hour | <4 hours | 173 | 42.5 | 225 | 56.5 | 0.541 | 0.291 | 1.005 | 0.049 |
| | > 4 hours | 27 | 58.7 | 19 | 41.3 | | | | |
| Gadget spending hours | < 5 hours | 119 | 40.3 | 176 | 59.7 | 0.568 | 0.381 | 0.845 | 0.005 |
| | > 5 hours | 81 | 54.4 | 68 | 45.6 | | | | |

**Table 3. X test regarding Parental Myopic Status and Onset of Myopia**

| | | Myopic onset | | | | | | p |
|---|---|---|---|---|---|---|---|---|
| | | Early onset | | Late onset | | Non-myopic | | |
| | | n | % | n | % | n | % | |
| Parental myopic status | Either one | 74 | 48.1 | 13 | 8.4 | 67 | 43.5 | <0.001 |
| | Both parents | 35 | 54.7 | 13 | 20.3 | 16 | 25.0 | |
| | No parent | 71 | 31.4 | 10 | 4.4 | 145 | 64.2 | |
| Total | | 180 | 40.5 | 36 | 8.1 | 228 | 51.3 | |

**Table 4. Multivariate Analysis Results**

| | Variable | Coefficient | p | PR |
|---|---|---|---|---|
| Step 1 | Myopic parent | 0.960 | <0.001 | 2.612(1.761-3.874) |
| | Gadget spending hour | 0.515 | 0.016 | 1.674(1.072-2.410) |
| | Female | 0.474 | 0.022 | 1.607(1.101-2.547) |
| | Reading spending hour | 0.401 | 1.493 | 1.493(0.777-2.868) |
| | Constanta | -1.165 | <0.001 | |

predisposition,this study suggest that neither near work nor outdoor activity was associated with SE, AL, and myopia. Reading habits and preschool activities also were not significantly associated with myopia.[2]

This study also showed that among those who have either one or both myopic parents, the proportion of early-onset myopia was significantly higher. This finding were consistent with previous study in Asian population. Chatrath et.al found that in genetically predisposed group, the early age of onset (11.03 ± 3.40 versus 12.98 ± 3.78), refractive power (right eye: 1.01 ± 0.96 versus 0.91 ± 0.57; left eye: 0.94 ± 0.71 versus 0.80 ± 0.62) was significantly increased (P < 0.05) when compared to the non-genetically predisposed group.[4]

Although reading and greater amount of contact with gadget may show a significant correlation toward myopia (p<0.05), genetic predisposition even has a stronger relation. This findings were inconsistent with study conducted by Ming Li,S et.al that showed continuous reading(> 45min), odds ratio[OR],1.4;95% confidence interval [CI],1.1-1.8; close television viewing distance (3m), OR, 1.7; 95% CI, 1.2-2.3; head tilt when writing, OR,1.3;95%CI,1.1-1.7,and desk lighting using fluorescent vs.incandescent lamp,OR, 1.5;95%CI,1.2-2.0.[3] Thesefactors, together with close reading distance and close nib-to fingertip distance were significantly associated with greater myopia (P<0.01).[3] But there were similarities with this study that among nearwork activities, only reading more books for pleasure was significantly associated with greater myopia (P=0.03).[3] This differences may be caused by lack of genetic predisposition as an independent variable in those study. Differences in methodological and details of physical activity exposure may also contribute.

We also found that proportion of myopic students that spend time reading more than 4 hours a day were greater than those who spend less time reading. This finding may support previous study conducted by Guo L et.al that reading for pleasure more than 2h per day (adjusted odds ratio=1.84, 95% CI=1.09–3.12) was positively associated with myopia in boys.[1]

This study also has many limitations, such as a questionnaire may not be the most accurate tool to assess near work or other activities associated with myopia. Although it is a common and accepted method to collect data, we could not completely rule out the possibility of recall bias. The degree of myopia also should be measured by a validated instrument such as Snellen chart or Autorefractometry. Although Guo et al was failed to find a significant association between outdoor activity and myopia,[1] some research suggest that outdoor activity may contribute to myopic tendency. Therefore we suggest to analyze time spending outdoor as an independent variable in further research.

## CONCLUSION

Parental myopic status remained the most important factor associated with early onset myopia, with smaller contributions from sex, reading spending hours and gadget spending hours. Further research with more samples and objective measurements may needed to support previous studies.

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