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THE DIFFERENCE OF RISK FACTORS BETWEEN MILD AND MODERATE-SEVERE REFRACTIVE ERRORS IN PEDIATRIC PATIENTS AT THE DIPONEGORO NATIONAL HOSPITAL

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ABSTRACT

Background: Refractive errors are the leading cause of visual impairment and the second leading cause of blindness worldwide. The incidence of refractive errors in children in Indonesia and in the world is quite high. The incidence of refractive errors can be triggered by several risk factors, including genetics, age, gender, close-range activities, use of electronic devices, and outdoor activities. **Objective:** Knowing the difference in risk factors between mild and moderate-severe refractive errors in pediatric patients at the Diponegoro National Hospital. **Methods:** This type of research is an analytic observational study with a cross sectional approach. Data were taken using a consecutive sampling technique from questionnaires and medical records of pediatric patients in the 2018-2021 period. The research subjects were 57 people who met the inclusion and exclusion criteria. Data were analyzed by univariate and bivariate analysis using Chi-Square and Mann Whitney analysis. **Results:** The research subjects were dominated by the age of 16-18 years (63.2%), female gender (68.4%), types of myopia disorders (57.9%), and mild degrees (66.7%). The results of the Chi-Square analysis showed that there was a significant difference in reading distance (p=0.000), reading position (p=0.035), duration of use of electronic devices (p=0.031), and duration of outdoor activities (p=0.042) between mild and moderate-severe degrees. **Conclusion:** There are significant differences in reading distance, reading position, duration of use of electronic devices, and duration of outdoor activities between mild and moderate-severe refractive errors in pediatric patients at the Diponegoro National Hospital.

Keywords: Refractive errors, risk factors, children

INTRODUCTION

Refractive errors are the most common vision problems that occur at all ages and are a major cause of visual impairment. The World Health Organization (WHO) states that refractive errors are the main cause of visual impairment and the second cause of blindness worldwide.[1] As many as 25% of the population in Indonesia have refractive errors and this case continues to increase from year to year.[2]

The World Health Organization (WHO) estimates that 2-10% of children worldwide suffer from refractive errors which are dominated by the school-age group (5-19 years).[2] The National Strategic Plan for the Prevention of Visual Impairment and Blindness (Renstranas) states that 22.1% of visual impairments are caused by refractive errors and 10% are school-age children (5-19 years).[3]

The incidence of refractive errors is triggered by the presence of predisposing factors for each individual. These risk factors include genetic factors and environmental factors. A study from Komariah *et al.* noted that the prevalence of myopia in children whose parents had myopia increased to 32.9%.[4] Environmental factors that influence the incidence of refractive errors include activities at close range, using gadgets, and lack of outdoor activities.[5] Visual disturbances due to refractive errors have a fairly high incidence in Indonesia and in the world, therefore refractive errors are a problem that needs to be considered, especially at the age of children so that they can be corrected as early as possible and do not interfere with the learning process.

Based on the description above and because there is still a lack of research on refractive errors in children and there is no research on the differences in risk factors between refractive errors in children, the researchers wanted to see what risk factors were found in children's refractive errors and whether there were differences in risk factors between mild degrees and moderate to severe refractive errors in children.

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METHODS

This research was conducted in August-October 2021 at the Diponegoro National Hospital. The research method used is an analytical observational study with a cross-sectional approach. The sample used in this study amounted to 57 people who met the inclusion and exclusion criteria. The inclusion criteria in this study were pediatric patients aged 6-18 years with refractive errors in one eye or both eyes who had performed eye refraction examinations at the Diponegoro National Hospital and were willing to be respondents in this study. Exclusion criteria in this study were patients who had eye disorders other than refractive errors, had congenital eye disorders, had a history of eye surgery, had a history of eye trauma, damaged or incomplete medical records, and incomplete questionnaires.

Sampling was done by consecutive sampling technique by selecting research samples that met the inclusion and exclusion criteria within a certain period until the target number of samples was met. The independent variables of this study were the risk factors for refractive errors, namely age, gender, family history, reading distance, watching TV distance, distance from using a laptop, distance from using a cellphone, reading position, duration of use of electronic devices, the position of playing gadgets and outdoor activities. while the dependent variable in this study is the degree of refractive error.

The data obtained are primary in the form of a questionnaire filled out by the patient and/or the patient's family and secondary data in the form of the patient's medical record. The data obtained were univariate analyses. Then to find out the relationship between the independent variable and the dependent variable, a bivariate analysis test was carried out, namely the Chi-Square test and using the Mann Whitney analysis test if it did not meet the Chi-Square requirements.

RESULTS

The results of the descriptive analysis obtained the characteristics of the research subjects as follows.

The table 1 shows that the highest age group of subjects is the SMA age group (16-18) with a total of 36 people (63.2%). The highest gender was female as many as 39 people (68.4%), then the most common type of disorder was myopia as many as 33 people (57.9%). The distribution of the highest degree of refractive error was the mild degree as many as 38 people (66.7%).

Table 1. Characteristics of Research Subjects

Variable	n	%
Age group		
- SD (6-12 years old)	9	15,8
- SMP (13-15 years old)	12	21,1
- SMA (16-18 years old)	36	63,2
Gender		
- Male	18	31,6
- Female	39	68,4
Type of refractive error		
- Myopia	33	57,9
- Hypermetropia	1	1,8
- Astigmatism	4	7,0
- Myopia + Astigmatism	17	29,8
- Hypermetropia + Astigmatism	2	3,5
Degree of refractive error		
- Mild	38	66,7
- Moderate-severe	19	33,3

The table 2 was tested for the alternative Chi-Square test, namely the Mann Whitney test and obtained a P value> 0.05. This shows that there is no significant age difference between mild and moderate-severe refractive errors.

Table 2. The age difference between mild and moderate-severe refractive errors

Age group	Degree of refraction		Abnormality		Total		p
	Mild		Moderate-severe				
	n	%	N	%	n	%	
SD (6-12)	4	44,4	5	55,6	**9**	**15,8**	0,374
SMP(13-15)	9	75	3	25	**12**	**21,1**	(P>0,05)
SMA(16-18)	25	69,4	11	30,6	**36**	**63,1**	

The table 3 does not show any significant gender differences between mild and moderate-severe refractive errors.

Table 3. Gender Differences between Mild and Moderate Refractive Disorders

Reading distance	Degree of refraction		Abnormality		Total		p
	Mild		Moderate-severe				
	n	%	N	%	n	%	
Male	14	77,8	4	22,2	**18**	**31,6**	1,462
Female	24	61,5	15	38,5	**39**	**68,4**	(P>0,05)

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The table 4 was tested for the alternative Chi-Square test, namely the Mann Whitney test and obtained a P value> 0.05. This shows that there is no significant difference in family history between mild and moderate-severe refractive errors.

Table 4. Differences in Family History between Mild and Moderate Refractive Disorders

Family History	Degree of Refraction		Abnormality		Total		p
	Mild		Moderate-severe				
	n	%	N	%	n	%	
Yes	30	63,8	17	36,2	**47**	**82,5**	0,329
No	8	80	2	20	**10**	**17,5**	(P>0,05)

The table 5 shows that there is a significant difference in reading distance between mild and moderate-severe refractive errors.

Table 5. Differences in reading distance between mild and moderate-severe refractive errors

Read-ing Distan-ce	Degree of Refraction		Abnormality		Total		p
	Mild		Moderate-severe				
	n	%	N	%	n	%	
< 30 cm	26	66,7	13	33,3	**39**	**68,4**	0,000
≥ 30 cm	12	66,7	6	33,3	**18**	**31,6**	(P<0,05)

The table 6 shows that there is no significant difference in TV viewing distance between mild and moderate-severe refractive errors.

Table 6. Differences in TV viewing distance between mild and moderate-severe refractive errors

TV Distan-ce	Degree of Refraction		Abnormality		Total		p
	Mild		Moderate-severe				
	n	%	N	%	n	%	
Near	23	71,9	9	28,1	**32**	**56,1**	0,891
Normal	15	60	10	40	**25**	**43,9**	(P>0,05)

The table 7 shows that there is no significant difference in distance between laptop or computer use between mild and moderate-severe refractive errors.

Table 7. Differences in Distance Using a Laptop between Mild and Moderate-Severe Refractive Disorders

Lapto Distan-ce	Degree of Refraction		Abnormality		Total		p
	Mild		Moderate-severe				
	n	%	N	%	n	%	
< 50 cm	17	54,8	14	45,1	**31**	**54,4**	4,279
≥50 cm	21	80,8	5	19,2	**26**	**45,6**	(P>0,05)

Table 8. Differences in Distance Using Mobile Phone between Mild and Moderate-severe Refractive Disorders

Mobile phone Distan-ce	Degree of Refraction		Abnormality		Total		p
	Mild		Moderate-severe				
	n	%	N	%	n	%	
<30 cm	34	70,8	14	29,2	**48**	**84,2**	0,127
≥30 cm	4	44,4	5	55,6	**9**	**15,8**	(P>0,05)

The table 8 shows that there is no significant difference in distance using a mobile phone between mild and moderate-severe refractive errors.

Table 9. Differences in Reading Position between Mild and Moderate Refractive Disorders

Reading Position	Degree of Refraction		Abnormality		Total		p
	Mild		Moderate-severe				
	n	%	N	%	n	%	
Sit Straight	21	67,7	10	32,3	**31**	**54,4**	0,035
Supine	17	65,4	9	34,6	**26**	**45,6**	(P<0,05)

The table 9 shows that there are differences in reading positions between mild and moderate refractive errors.

Table 10. Differences in the duration of using electronic devices between mild and moderate-severe refractive errors

Duration of Use of Electronic Device	Degree of Refraction		Abnormality		Total		p
	Mild		Moderate-severe				
	n	%	N	%	n	%	
1-3 hours	5	55,6	4	44,4	**9**	**15,8**	0,031
3-8 hours	17	56,7	13	43,3	**30**	**52,6**	(P<0,05)
7-9 hours	16	88,9	2	11,1	**18**	**31,6**	

The table 10 shows the difference in the duration of the use of electronic devices between mild and moderate-severe refractive errors.

Table 11. Differences in Gadget Playing Positions between Mild and Moderate Refractive Disorders

Position when playing gatget	Degree of Refraction		Abnormality		Total		p
	Mild		Moderate-severe				
	n	%	N	%	n	%	
Sit Straight	15	60	10	40	**25**	**43,9**	0,891
Supine	23	71,9	9	28,1	**32**	**56,1**	(P>0,05)

The table 11 shows that there is no difference in position when playing gadgets between mild and moderate-severe refractive errors.

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Table 12. Differences in the duration of outdoor activities between mild and moderate-severe refractive errors

Duration of Outdoor Activities	Degree of Refraction		Abnormality		Total		p
	Mild		Moderate-severe				
	n	%	N	%	n	%	
0-5 hours	27	67,5	13	32,5	**40**	**70,2**	0,042
≥ 6 hours	11	64,7	6	35,3	**17**	**29,8**	(P<0,05)

The table 12 shows that there are significant differences in the duration of outdoor activities between mild and moderate-severe refractive errors.

DISCUSSION

Characteristics of the subjects from this study obtained the highest age group is the SMA age group (16-18 years) as many as 36 people (63.2%). This is in line with the research of Hayatillah *et al*., that the incidence of refractive errors, especially myopia, increases and becomes more progressive with age, this is because the eyeball is still elongating and changes in components occur.[6]

Characteristics of subjects based on gender in this study, the highest frequency of subjects was female, as many as 39 people (68.4%). This is by research by Arsa (2018), Fauziah (2013) and Musiana (2019) where more female than male subjects have refractive errors.[7,8]

The highest frequency of refractive error was myopia, which was 33 people (57.9%) and myopia accompanied by astigmatism was 17 people (29.8%). Then followed by other types of refractive errors. This is similar to the research by Ihsanti (2014) where the most common types of refractive errors are astigmatism (77 people) and myopia (54 people). [9]

The highest degree of refractive error in this study was mild, as many as 38 people (66.7%). This study is in line with Ihsanti's (2014) research, namely the degree of refraction of the most subjects is mild.[9] This is also following the research of Fauziah (2013) where more than half of the respondents suffer from mild myopia (76.9%).[8] There is a theory that states that individuals without myopia predisposing factors who are exposed to persistent myopigenic factors can eventually develop mild myopia.[8]

In this study, it was found that the distribution of research subjects, namely pediatric patients with refractive errors, was the SMA age group (16-18 years) as many as 36 people (63.2%). After the Mann Whitney test was carried out, the results obtained P value> 0.05, this indicates that there is no age difference between mild and moderate-severe refractive errors. This study is in line with Ihsanti's research (2014) which obtained results from statistical tests, namely the P value > 0.05, which means that there is no relationship between age and the degree of refractive error.[9]

This study shows that the majority of the subjects were female as many as 39 people (68.4%), while the male sex was 18 people (31.6%). This is because women have the axial length of the eyeball which is higher and has a deeper vitreous chamber than men.[10] In addition, the high activity of looking closely and the lack of outdoor activity in girls when compared to boys increases the risk of girls having a higher refractive error than boys.[11] After carrying out the Chi Square test in this study, it was found that there was no gender difference between mild and moderate-severe refractive errors. This is in line with the research of Musiana (2019) and Ihsanti (2014) which obtained research results with a significance value of P>0.05, indicating that there was no relationship between gender and the degree of refractive error in children.[7,9]

In this study, data obtained that most of the subjects had a family history, namely 82.5% of the subjects had a history of descendants from families suffering from refractive errors, whether from father, mother, or siblings. The same is the case with Arsa's research (2018), from the results of the study, it was found that 60.2% of respondents had a history of parental descent.[10] Genetic factors can reduce refractive errors in their offspring either autosomal recessively or autosomal dominantly.[4] In the research of Arsa (2018) and Musiana (2019) found that there was a relationship between family history factors and the incidence of refractive errors.[7,10] However, in this study, the results were obtained using an analytical test with P value> 0.05. This shows that there is a significant difference in family history between the presence and absence of refractive errors, but there is no significant difference between mild and moderate-severe refractive errors.

In this study, the reading distance or the distance between the eyes and the book resulted in a significant difference between mild and moderate-

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severe refractive errors. This study is in line with the research of Enira (2016) and Ardifansyia (2019) with a P value <0.05 so that it shows a significant relationship between near-sight distance such as reading activities and the incidence of refractive errors.[12,13] Refractive abnormalities were more commonly found in children who read books at a distance of < 30 cm. This is by the theory that reading at close distances and for long periods can cause continuous accommodation so that the ciliary muscle tone becomes high and the lens becomes convex, then causes objects to fall in front of the retina or cause myopia.[7]

In this study, it was found that there was no significant difference in television viewing distance between mild and moderate-severe refractive errors. This study is not by the research of Enira (2016) and Fachrian *et al.* (2009) which stated that there was a significant relationship between television viewing distance and the incidence of refractive errors.[12,14] This indicates that there is a significant difference in television viewing distance between the presence and absence of refractive errors. , but there is no significant difference in television viewing distance between degrees of refractive error. However, this requires further research with a larger and more heterogeneous sample.

This study also showed that there was no significant difference in eye distance when using a laptop or computer between mild and moderate-severe refractive errors. This study is not in line with the theory which states that when using a laptop or computer or cellphone at a close distance for a long time will cause prolonged ciliary muscle pressure. This will cause the axis of the eyeball to be elongated so that the focal point of the image will be farther in front of the retina so that the degree of myopia will increase.[10] This difference shows that distance from using a laptop or computer is related to the incidence of refractive errors, but is not significantly related to the degree of abnormality refraction.

This study also showed that there was no significant difference in eye distance when using mobile phone between mild and moderate-severe refractive errors. This study is not in line with the theory which states that when using a cellphone at a close distance for a long time will cause continuous accommodation and can cause the formation of a blurry image on the retina. This will stimulate chemical processes in the retina to process biochemical and structural changes in the choroid and sclera causing axial elongation.[15] Based on this theory and research, it shows that looking closely for a long time is associated with the presence or absence of refractive errors, but is not significantly related to the degree of refractive error.

This study found that there was a significant difference in reading position between mild and moderate-severe refractive errors. The lying or reclining position is one of the bad habits that can increase the risk of refractive errors.[7] This is by the theory that the supine lying position while reading can cause the progression of refractive errors due to extraocular muscle contractions that can affect the elongation of the eyeball. So that it can cause different tension in both the extraocular muscles and eyelid pressure.[13]

In this study, most of the subjects in a day the duration of using electronic devices were 3-8 hours (moderate category) as many as 30 subjects (52.6%). This study is in line with Makkasau's research (2017) where the distribution of research subjects is based on the most duration, namely in the medium category (41.1%) and the severe category (43.3%).[16] which means between mild and moderate-severe refractive errors. This is in line with the results of research conducted by Musiana (2019) that respondents who have close-range activities of more than 5 hours a day have an 11,560 times greater risk than respondents who have close-range activities of less than 5 hours a day.[7]

This study shows that there is no significant difference in the position of playing gadgets between mild and moderate-severe refractive errors. This is not in line with the theory which says that the lying position is a bad habit that can interfere with eye health and increase the risk of refractive errors.[7] This difference could be because in this study the comparison between samples with moderate-severe degrees and samples with mild degrees showed more Mild degree samples who have the habit of playing gadgets while lying down, this shows that the moderate-severe samples have better awareness and habits regarding the position of playing gadgets.

In this study, the results obtained with the Chi-Square test, P-value <0.05, indicating a significant difference in the duration of outdoor activity

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between mild and moderate-severe refractive errors. This study is in line with research by Arsa (2018) and Septiany (2015) who found a relationship between outdoor activities and the incidence of refractive errors.[10,17] Outdoor activity can be a protective factor that can prevent refractive errors, especially myopia. This is because outdoor activities can increase the depth of focus and retinal clarity, resulting in pupillary constriction due to high light intensity and reduced eye effort to see at close range when indoors. The greater the intensity of light outdoors, the greater the protection against myopia.[15]

CONCLUSION

The results of this study indicate that there are significant differences in reading distance, reading position, duration of use of electronic devices, and duration of outdoor activities between refractive errors of mild and moderate-severe degrees in pediatric patients at Diponegoro National Hospital.

ETHICAL APPROVAL

This research was conducted after obtaining ethical clearance from the Health Research Ethics Commission (KEPK) Faculty of Medicine, Diponegoro University with Number 244/EC/KEPK/FK-UNDIP/VII/2021 and obtaining research permission from the Diponegoro National Hospital. The data obtained in this study is only used for research purposes and is confidential.

CONFLICT OF INTEREST

There are no conflict of interest in this study.

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