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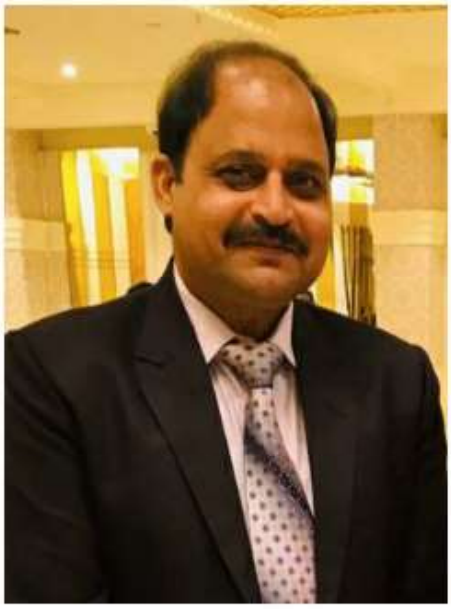

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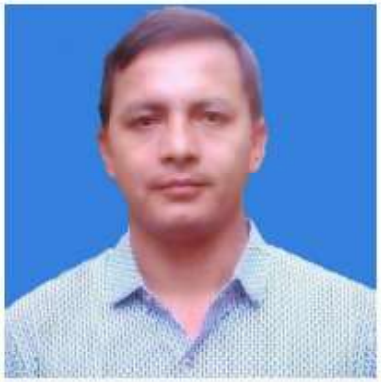

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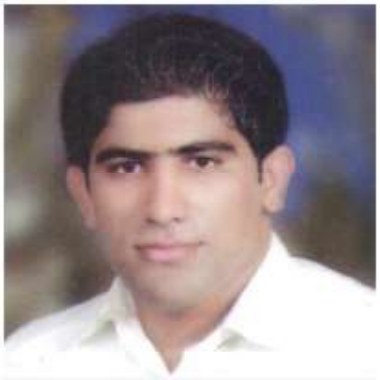

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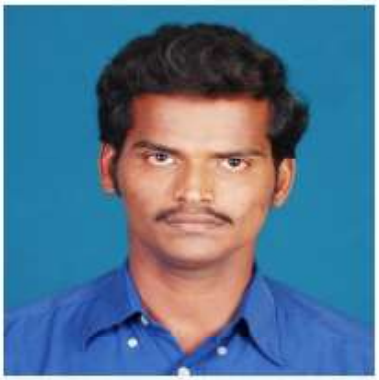

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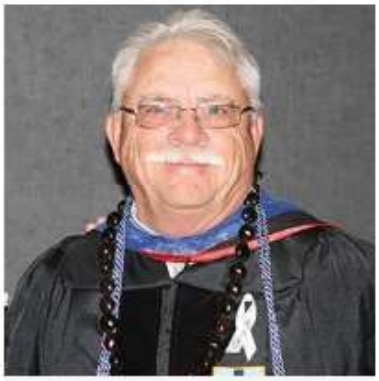

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Dry eye disease and its risk factors in rural and urban areas in Indonesia

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Dry eye disease and its risk factors in rural and urban areas in Indonesia

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Abstract
This cross-sectional study was conducted in two regions in Indonesia, Karawaci Banten and Depok City to determine the risk factors of Dry Eye Disease (DED) in rural and urban areas. To assess DED, the Schirmer test was performed on one eye (right eye). The risk factors being studied were age, gender, smoking habits, and the use of electronic devices. A total of 145 respondents was recruited, with 60 respondents (41.4%) from rural areas and 85 respondents (58.6%) from urban areas. The prevalence of DED was higher in urban areas, with 54.1% (46/85) compared to 48.3% (29/60) in rural areas. There was no significant association between age and gender with the incidence of DED in both rural and urban areas ($p>0.05$). Smoking was significantly associated with DED incidence in rural areas ($p=0.0004$), but not in urban areas. The use of electronic devices was significantly associated with DED incidence only in urban areas ($p=0.043$). Smoking is a risk factor for DED in rural areas, while the use of electronic devices is the main risk factor in urban areas.

Keywords: Dry Eye Disease, Rural, Urban, Schirmer.

1. Introduction
Dry eye disease is defined by the Report of the Definition and Classification Subcommittee of the International Dry Eye WorkShop as a multifactorial disease of the tears and ocular surface, which results in symptoms of discomfort, visual disturbance, and tear film instability, with potential damage to the ocular surface.[1] The prevalence of dry eye disease ranges from 5-35% of the population worldwide, with Nigeria having a prevalence of 19.2%,[2] China 17%,[3] and Dubai 62.6%.[4] In Indonesia, the prevalence of dry eye disease is 27.5% in a study conducted in the Riau Islands.[5] The purpose of this study is to compare the incidence of dry eye disease in rural and urban areas based on risk factors such as age, gender, smoking habits and the use of electronic devices.

2. Methods
This cross-sectional study was conducted in two regions in Indonesia, Karawaci Banten as a rural area and Depok City as an urban area. The exclusion criteria were the presence of signs of eye infection, the use of contact lenses, and the use of routine eye drops for the last 6 months. After signing the informed consent and filling out the identity sheet, there were several additional questions regarding smoking habits, and the use of electronic devices. The eye examination performed was a Schirmer's test just to the right eye to assess the quantity of tears. The Schirmer test was performed by an ophthalmologist without anesthetic using Whatman No. 41 filter paper, which is 5 mm wide and 30 mm long. The tip of the Schirmer paper was folded about 5 mm and inserted into the inferior fornix conjunctiva. The eye was closed and left for 5 minutes. After 5 minutes, the length of the wetted Schirmer paper was measured. DED was indicated if the wetted Schirmer paper was less than 10 mm.[6]
All data were analyzed using the GraphPad version 9 program. The data collected was presented in the form of frequency and percentage distributions. Bivariate analysis of two groups was performed using the Chi-square test, if certain conditions were met with a significance level of $p<0.05$. If not, the Fisher's exact test was used.

2. Result

A total of 145 respondents participated in the research, with 60 respondents (41.4%) from rural areas and 85 respondents (58.6%) from urban areas. The respondents were divided into two age groups, the age group of 30-50 years old consisted of 79 respondents (54,5%), while the age group of over 50 years old consisted of 66 respondents (45,5%). The prevalence of DED was 48.3% in the rural group (n=60) and 54.1% in the urban group (n=85). The demographic profile of the study subjects in rural and urban areas is presented in Table 1.

Table 2 shows various risk factors for Dry Eye Disease in both rural and urban areas. According to our research, age and gender did not have a significant relationship with the incidence of Dry Eye Disease (p>0.05). However, smoking habits were significantly associated with the incidence of Dry Eye Disease in rural areas (p=0.0004), but not in urban areas. On the other hand, excessive use of electronic devices was the main risk factor for Dry Eye Disease in urban areas (p=0.043).

Table 1: Characteristics of respondents in Rural and Urban areas.

Characteristics		Rural		Urban	
		n = 60	%	n = 85	%
Gender					
	Male	26	43,3	33	38,8
	Female	34	56,7	52	61,2
Ages					
	30 - 50	44	73,3	35	41,2
	More than 50	16	26,7	50	58,8
Smoking habits					
	Yes	13	21,7	23	27,1
	No	47	78,3	62	72,9
Use of electronic devices					
	Yes	43	71,7	33	38,8
	No	17	28,3	52	61,2
Dry Eye (Schirmer)					
	Yes	29	48,3	46	54,1
	No	31	51,7	39	45,9

Table 2: Distribution of Dry Eye Disease based on Risk Factors in Rural and Urban Areas.

Risk Factors		Rural (n = 60)					Urban (n = 85)				
		Dry Eye (Schirmer)				p	Dry Eye (Schirmer)				p
		Yes		No			Yes		No		
		n	%	n	%		n	%	n	%	
Gender											
	Male	15	25,0	11	18,3	0,205	14	16,5	19	22,4	0,085
	Female	14	23,3	20	33,3		32	37,6	20	23,5	
Ages											
	30 - 50	19	31,7	25	41,7	0,185	19	22,4	16	18,8	0,979
	More than 50	10	16,7	6	10,0		27	31,8	23	27,0	
Smoking habits											
	Yes	12	20,0	1	1,7	0,0004*	9	10,6	15	17,6	0,054
	No	17	28,3	30	50,0		37	43,5	24	28,2	
Use of electronic devices											
	Yes	21	35,0	22	36,7	0,901	17	20,0	23	27,1	0,043
	No	8	13,3	9	15,0		29	34,1	16	18,8	

* Fisher test

4. Discussion

The prevalence of DED based on Schirmer examination in this study was 48.3% in rural areas and 54.1% in urban areas. This number has increased compared to the results of a study conducted in Indonesia in 2002, which had a prevalence of 27.5%.[5] A relatively high prevalence was also found in Hotan, China, where the prevalence reached 40.6%,[7] while the prevalence in a study in rural areas of India was 45.39%.[8] A study in Ghana, Africa compared the prevalence of DED in rural and urban areas, and the results showed that respondents in rural areas suffered more from DED and had more severe symptoms than respondents in urban areas.[9] DED usually affects older individuals, with its prevalence increasing as age increases. Women are at a higher risk of developing DED compared to men. [10-15] This is supported by clinical examinations that have found a decrease in tear production in individuals in their sixth decade of life.[10]

In his research on the effects of smoking on tear proteins, Grus found that there were changes in the tear film of a smoker, where there was an increase in protein spots due to toxins from cigarettes that caused oxidative damage to the proteins.[16] This explains why smoking is a risk factor for Dry Eye Disease. The research conducted in Saudi Arabia regarding electronic cigarettes, which are claimed to be an alternative to conventional cigarettes that are safe and non-addictive, has found that they are actually unsafe and can cause health issues such as nausea, vomiting, headaches, dryness around the mouth, eyes, and mucous membranes.[17] In our research, there is a positive

correlation between smoking habits and the incidence of Dry Eye Disease in rural areas (p=0,0004).

Several literature states that excessive use of electronic devices can cause dry eyes. A study in Serbia with a population of 18–34-year-old students found a prevalence of Dry Eye Disease (DED) of 60.5%. Electronic devices have a significant relationship with the occurrence of DED, and the longer the duration of electronic device use, the higher the prevalence of DED. [18] To assess the effect of smartphones on the onset of DED symptoms, tear film and oxidative stress in the eyes, Choi conducted a case-control study, and the results showed that using electronic devices for more than 4 hours would worsen DED symptoms and lead to oxidative stress in the eyes.

5. Conclusion

The habit of smoking and excessive use of electronic devices can cause damage to the tear film layer, resulting in DED symptoms. It is necessary to explain this to the public, both in rural and urban areas.

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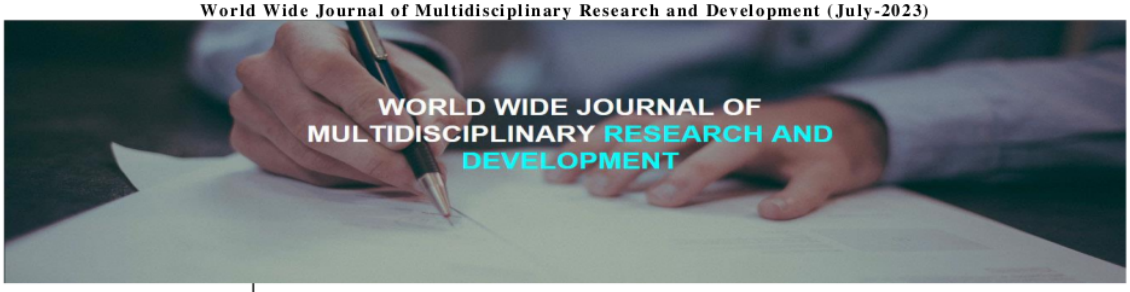

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Dry eye disease and its risk factors in rural and urban areas in Indonesia

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Abstract
This cross-sectional study was conducted in two regions in Indonesia, Karawaci Banten and Depok City to determine the risk factors of Dry Eye Disease (DED) in rural and urban areas. To assess DED, the Schirmer test was performed on one eye (right eye). The risk factors being studied were age, gender, smoking habits, and the use of electronic devices. A total of 145 respondents was recruited, with 60 respondents (41.4%) from rural areas and 85 respondents (58.6%) from urban areas. The prevalence of DED was higher in urban areas, with 54.1% (46/85) compared to 48.3% (29/60) in rural areas. There was no significant association between age and gender with the incidence of DED in both rural and urban areas (p>0.05). Smoking was significantly associated with DED incidence in rural areas (p=0.0004), but not in urban areas. The use of electronic devices was significantly associated with DED incidence only in urban areas (p=0.043). Smoking is a risk factor for DED in rural areas, while the use of electronic devices is the main risk factor in urban areas.

Keywords: Dry Eye Disease, Rural, Urban, Schirmer.

1. Introduction

Dry eye disease is defined by the Report of the Definition and Classification Subcommittee of the International Dry Eye WorkShop as a multifactorial disease of the tears and ocular surface, which results in symptoms of discomfort, visual disturbance, and tear film instability, with potential damage to the ocular surface.[1] The prevalence of dry eye disease ranges from 5-35% of the population worldwide, with Nigeria having a prevalence of 19.2%,[2] China 17%,[3] and Dubai 62.6%.[4] In Indonesia, the prevalence of dry eye disease is 27.5% in a study conducted in the Riau Islands.[5] The purpose of this study is to compare the incidence of dry eye disease in rural and urban areas based on risk factors such as age, gender, smoking habits and the use of electronic devices.

2. Methods

This cross-sectional study was conducted in two regions in Indonesia, Karawaci Banten as a rural area and Depok City as an urban area. The exclusion criteria were the presence of signs of eye infection, the use of contact lenses, and the use of routine eye drops for the last 6 months. After signing the informed consent and filling out the identity sheet, there were several additional questions regarding smoking habits, and the use of electronic devices. The eye examination performed was a Schirmer's test just to the right eye to assess the quantity of tears. The Schirmer test was performed by an ophthalmologist without anesthetic using Whatman No. 41 filter paper, which is 5 mm wide and 30 mm long. The tip of the Schirmer paper was folded about 5 mm and inserted into the inferior fornix conjunctiva. The eye was closed and left for 5 minutes. After 5 minutes, the length of the wetted Schirmer paper was measured. DED was indicated if the wetted Schirmer paper was less than 10 mm.[6]
All data were analyzed using the GraphPad version 9 program. The data collected was presented in the form of frequency and percentage distributions. Bivariate analysis of two groups was performed using the Chi-square test, if certain conditions were met with a significance level of $p<0.05$. If not, the Fisher's exact test was used.

2. Result

A total of 145 respondents participated in the research, with 60 respondents (41.4%) from rural areas and 85 respondents (58.6%) from urban areas. The respondents were divided into two age groups, the age group of 30-50 years old consisted of 79 respondents (54,5%), while the age group of over 50 years old consisted of 66 respondents (45,5%). The prevalence of DED was 48.3% in the rural group (n=60) and 54.1% in the urban group (n=85). The demographic profile of the study subjects in rural and urban areas is presented in Table 1.

Table 2 shows various risk factors for Dry Eye Disease in both rural and urban areas. According to our research, age and gender did not have a significant relationship with the incidence of Dry Eye Disease (p>0.05). However, smoking habits were significantly associated with the incidence of Dry Eye Disease in rural areas (p=0.0004), but not in urban areas. On the other hand, excessive use of electronic devices was the main risk factor for Dry Eye Disease in urban areas (p=0.043).

Table 1: Characteristics of respondents in Rural and Urban areas.

Characteristics		Rural		Urban	
		n = 60	%	n = 85	%
Gender					
	Male	26	43,3	33	38,8
	Female	34	56,7	52	61,2
Ages					
	30 - 50	44	73,3	35	41,2
	More than 50	16	26,7	50	58,8
Smoking habits					
	Yes	13	21,7	23	27,1
	No	47	78,3	62	72,9
Use of electronic devices					
	Yes	43	71,7	33	38,8
	No	17	28,3	52	61,2
Dry Eye (Schirmer)					
	Yes	29	48,3	46	54,1
	No	31	51,7	39	45,9

Table 2: Distribution of Dry Eye Disease based on Risk Factors in Rural and Urban Areas.

Risk Factors		Rural (n = 60)					Urban (n = 85)				
		Dry Eye (Schirmer)				p	Dry Eye (Schirmer)				p
		Yes		No			Yes		No		
		n	%	n	%		n	%	n	%	
Gender											
	Male	15	25,0	11	18,3	0,205	14	16,5	19	22,4	0,085
	Female	14	23,3	20	33,3		32	37,6	20	23,5	
Ages											
	30 - 50	19	31,7	25	41,7	0,185	19	22,4	16	18,8	0,979
	More than 50	10	16,7	6	10,0		27	31,8	23	27,0	
Smoking habits											
	Yes	12	20,0	1	1,7	0,0004*	9	10,6	15	17,6	0,054
	No	17	28,3	30	50,0		37	43,5	24	28,2	
Use of electronic devices											
	Yes	21	35,0	22	36,7	0,901	17	20,0	23	27,1	0,043
	No	8	13,3	9	15,0		29	34,1	16	18,8	

* Fisher test

4. Discussion

The prevalence of DED based on Schirmer examination in this study was 48.3% in rural areas and 54.1% in urban areas. This number has increased compared to the results of a study conducted in Indonesia in 2002, which had a prevalence of 27.5%.[5] A relatively high prevalence was also found in Hotan, China, where the prevalence reached 40.6%,[7] while the prevalence in a study in rural areas of India was 45.39%.[8] A study in Ghana, Africa compared the prevalence of DED in rural and urban areas, and the results showed that respondents in rural areas suffered more from DED and had more severe symptoms than respondents in urban areas.[9] DED usually affects older individuals, with its prevalence increasing as age increases. Women are at a higher risk of developing DED compared to men. [10-15] This is supported by clinical examinations that have found a decrease in tear production in individuals in their sixth decade of life.[10]

In his research on the effects of smoking on tear proteins, Grus found that there were changes in the tear film of a smoker, where there was an increase in protein spots due to toxins from cigarettes that caused oxidative damage to the proteins.[16] This explains why smoking is a risk factor for Dry Eye Disease. The research conducted in Saudi Arabia regarding electronic cigarettes, which are claimed to be an alternative to conventional cigarettes that are safe and non-addictive, has found that they are actually unsafe and can cause health issues such as nausea, vomiting, headaches, dryness around the mouth, eyes, and mucous membranes.[17] In our research, there is a positive

correlation between smoking habits and the incidence of Dry Eye Disease in rural areas (p=0,0004).

Several literature states that excessive use of electronic devices can cause dry eyes. A study in Serbia with a population of 18–34-year-old students found a prevalence of Dry Eye Disease (DED) of 60.5%. Electronic devices have a significant relationship with the occurrence of DED, and the longer the duration of electronic device use, the higher the prevalence of DED. [18] To assess the effect of smartphones on the onset of DED symptoms, tear film and oxidative stress in the eyes, Choi conducted a case-control study, and the results showed that using electronic devices for more than 4 hours would worsen DED symptoms and lead to oxidative stress in the eyes.

5. Conclusion

The habit of smoking and excessive use of electronic devices can cause damage to the tear film layer, resulting in DED symptoms. It is necessary to explain this to the public, both in rural and urban areas.

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