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The effect of smoking degree on the incidents of cataracts

Efecto del grado de fumar sobre los incidentes de cataratas

Nyimas Salsabila Rahma[1*], Yudith Annisa Ayu Rezkitha[2*•], Kaniraras Lintang Prameswari[3*], Kartika Prahasanti[4*]

SUMMARY

Introduction: *A cataract is a condition of the eye lens experiencing turbidity. It is the highest cause of blindness in the world. Smoking is one of the risk factors for cataracts. According to the Brinkman index, the degree of smoking is a multiplication between smoking time and the number of cigarettes consumed in a day. This study aims to analyze the influence of smoking degree on cataracts.*
Methods: *This study employed a cross-sectional research design. The respondents were taken with a consecutive sampling method on 96 cataract patients from December 2019 to January 2020.*
Results: *According to the Brinkman index, most respondents of the study aged 40-59 years were classified into the heavy smoking degree. Most respondents aged ≥ 60 years were classified into mild smoking degrees according to the Brinkman index. Chi-square test results showed a significant difference between heavy smoking and not smoking on the age at which cataracts are diagnosed (p=0.004). There were no significant differences between patients who did not smoke and patients who had mild to moderate degrees of smoking to the age of cataract patients (p=0.085, p=1, respectively). The Spearman test analyzed the correlation between the smoking degree and the age at which cataracts were diagnosed obtained a value of -0.380.*
Conclusion: *There is a significant relationship between smoking degree with the cataract incident on the age at which cataracts are diagnosed.*

Keywords: *Smoking degree, cataract, the Brinkman index.*

RESUMEN

Introducción: *Una catarata es una condición en la que el cristalino del ojo experimenta turbidez. Es la mayor causa de ceguera en el mundo. Fumar es uno de los factores de riesgo de cataratas. Según el índice de Brinkman, el grado de tabaquismo es una multiplicación entre el tiempo que se fuma y la cantidad de cigarrillos consumidos en un día. Este estudio tiene como objetivo analizar la influencia del grado de tabaquismo en las cataratas.*

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ORCID: 0000-0003-3598-1382[1]
ORCID: 0000-0001-7600-9114[2]
ORCID: 0000-0003-3118-2452[3]
ORCID: 0000-0002-1998-4535[4]

[*]*Faculty of Medicine, Muhammadiyah University of Surabaya, Surabaya 60113, Indonesia*

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• Corresponding author: Yudith Annisa Ayu Rezkitha, MD
Faculty of Medicine, Muhammadiyah University of Surabaya, Surabaya, Indonesia, Jalan Sutorejo no. 59, Surabaya 60113, Indonesia.
Tel: +6231-3811966; Fax: +6231-3812096
E-mail: yudithannisaayu@gmail.com

Métodos: *Este estudio empleó un diseño de investigación transversal. Los encuestados se tomaron con un método de muestreo consecutivo en 96 pacientes con cataratas desde diciembre de 2019 hasta enero de 2020.*
Resultados: *Según el índice de Brinkman, la mayoría de los encuestados del estudio con edades comprendidas entre los 40 y los 59 años se clasificaron en el grado de tabaquismo intenso. La mayoría de los encuestados de edad ≥ 60 años se clasificaron en grados de tabaquismo leve según el índice de Brinkman. Los resultados de la prueba de Chi-cuadrado mostraron una diferencia significativa entre fumar mucho y no fumar en la edad a la que se diagnostican las cataratas (p=0,004). No hubo diferencias significativas entre los pacientes que no fumaban y los pacientes que tenían grados de tabaquismo de leve a moderado hasta la edad de los pacientes con cataratas (p=0,085, p=1, respectivamente). La prueba de Spearman analizó la correlación entre el grado de tabaquismo y la edad a la que se diagnosticaron cataratas obtuvo un valor de -0,380.*
Conclusión: *Existe una relación significativa entre el grado de tabaquismo y el incidente de cataratas y la edad a la que se diagnostican las cataratas.*

Palabras clave: *Grado de tabaquismo, catarata, índice de Brinkman.*

INTRODUCTION

The eyes have the responsibility to visual and sight, which can be damaged (1). A cataract is one of the conditions where the eye's lens becomes cloudy due to the denaturation of protein in the lens, hydration (addition of fluid) to the lens, or both. Cataracts are characterized by gradual clouding of the lens, which eventually leads to total blindness. Cataracts are the leading cause of blindness in Indonesia (0.78 %) and worldwide (2). Cataract surgery is the most commonly performed operation to treat visual disorders (3-5). However, it has an expensive charge, and most people with cataracts in Indonesia have not yet got surgery due to several factors (6-8). One of the factors cataract patients did not undergo surgery is the attitude that had a dominant influence on the intention to undergo cataract surgery (9). The estimated incidence of cataracts is 0.1 % every year, or among 1 000 people, there is a new cataract sufferer every year. The Indonesian also tends to suffer cataracts 15 years earlier than the population in subtropical areas (10,11).

The pathogenesis of cataracts is not fully understood. However, in a cataract patient's lens, there are protein aggregates that scatter the light beam. A change in protein structure reduces the lens's transparency and induces discoloration of the lens. Additional findings may include vesicles between the lens fibers or epithelial cell migration and abnormal enlargement of epithelial cells. Several factors are thought to play a role in forming cataracts, including oxidative damage (from free radical processes), ultraviolet light, and malnutrition. Until now, no treatment has been found that can slow or reverse the chemical changes that underlie cataract formation (12). The risk factors for cataracts consist of protective, environmental, and individual factors. Protective factors include the use of aspirin and hormone therapy in women. Environmental factors consist of smoking habits, ultraviolet exposure, education level, socioeconomic status, hypertension, diabetes mellitus, steroids, and drugs for gout. Individual factors include gender, age, genetic factors, and race (13).

The smoking habit is an avoidable risk factor. The negative impacts of smoking on health are always listed on cigarette packages, but Indonesians do not care about it. The number of smokers in Indonesia is increasing every year. The number of smokers in Indonesia is even in the third position in the world after China and India (14). Cigarettes are processed tobacco wrapped in cigars or other forms produced by the *Nicotiana tabacum*, *Nicotiana rustica*, and other species or their synthesis containing nicotine and tar with or without additives (15). In tobacco use, there are no established safe thresholds that can be applied in low exposure.

The cigarette smoke component inhaled by smokers consists of part gas (85 %) and part gas (15 %). Cigarettes contain approximately 4 000 types of chemicals, with 60 types of carcinogens (which can cause cancer) (16). The ingredients of cigarettes that can affect the lens are nitric oxide and superoxide anions. These substances cause oxidative stress in the lens and cause the formation of malondialdehyde through lipid peroxidation. Malondialdehyde will form a cross-link between the protein and the lipid membrane, resulting in lens turbidity (cataract) through crystalline

aggregation and the inactivation of antioxidant enzymes in the lens (17).

According to the Brinkman index, the degree of smoking is the result of multiplying the length of smoking by the average number of cigarettes consumed per day. If the result is less than 200, it is called a mild smoker, if the result is between 200-599, it is said to be a moderate smoker, and if the result is more than 600, it is said to be a heavy smoker. The more cigarettes consumed, the longer the smoking, the heavier the smoking degree (15). Smoking as a lifestyle is now starting used in adolescence and even in children. Therefore, this study aims to see the effect of smoking on the incidence of cataracts at a Private Hospital in East Java, Indonesia.

METHODS

This study used a cross-sectional study design. This study's population was cataract patients registered at a Private Hospital in East Java, Indonesia. The subjects of this study were taken by consecutive sampling method with criteria defined in 96 cataract patients. The study was conducted from December 2019 to January 2020. The sample criteria used were cataract patients who were over 40 years old and did not have a history of congenital cataracts, juvenile cataracts, glaucoma, diabetic cataracts, traumatic cataracts, and inflammatory eye disease. The research sample will be selected based on medical records. The selected sample will receive a questionnaire asking for identity, history, education level, and smoking history. The results of the observations were then processed using the chi-square and spearman tests using the SPSS Statistics 25 application. The chi-square test was used to find significant differences between smoking degrees and the age at which cataracts were diagnosed. The Spearman test was performed to determine the effect of smoking on cataracts.

RESULTS

Table 1 describes the respondents' characteristics that most of the cataract patients are male and aged ≥60 years. Most of the respondents have an elementary education background or equivalent, and the majority work as farmers.

Table 1

Respondents' Characteristics

Variable	Frequency	Percentage
Sex		
Male	78	81.3
Female	18	18.7
Age (Year)		
40-59	42	43.8
≥60	54	56.2
Educational Stage		
Do not go to school	22	22.9
Elementary School	43	44.8
Junior High School	7	7.3
Senior High School	15	15.6
College	9	9.4
Occupation		
Housekeeping	7	7.3
General Employees	24	25.0
Government Employees	6	6.3
Farmers	34	35.4
Trader	4	4.2
Teacher	4	4.2
Retired	2	2.1
Enterpreneur	12	12.5
Another Job	2	2.1
Freelance	1	1.0
Total	96	100.0

The age category on cataract patients was classified as 40-59 years old and ≥60 years. The Chi-square test obtained no significant difference between non-smoking and mild smoking on the age at which cataracts were diagnosed (p=0.085). There was also no difference between non-smoking and moderate smoking at the age at which cataracts were diagnosed (p=1). However, there was a difference between not smoking and heavy smoking at the age of cataract diagnosis (p=0.004). Table 2 shows that the Spearman method's test results were -0.380 indicating a sufficient correlation between the smoking degree and the age at which cataracts were diagnosed.

Table 2

Effect of smoking degree on cataract incidence

Age	Smoking Degree				Total
	Non-Smoking	Mild	Moderate	Heavy	
40-59 Years	9	5	5	23	42
≥60 Years	14	28	7	5	54
Total	23	33	12	28	96

The result using Spearman method = -0.380

DISCUSSION

This study found that most respondents with a heavy smoking degree suffered from cataracts at the age of 40-59 years. Most cataract patients diagnosed at ≥60 years old had mild smoking degrees and had no smoke history. The number of cataract sufferers with the degree of mild smoking was twice as high compared with the number of cataract patients who do not smoke at ≥60 years old. There is a significant difference between cataract patients who do not smoke and the heavy smoking degree to the incidence of cataracts. The lens can experience the turbidity of the reactive oxygen species (ROS) contained in cigarettes (17). ROS is a substance that can cause membrane lipid peroxidation and form malondialdehyde. Malondialdehyde will destroy cells by forming cross-links between proteins and lipid membranes. The lens has enzymes that function to protect against free radicals, including catalase and glutathione peroxidase. However, polymerization and cross-linking of these proteins lead to the inactivation of lens protective enzymes and crystalline aggregation (17). Also, there was an influence between smoking habits and the incidence of cataracts. Respondents with a history of smoking had a 5.182 times higher risk of developing cataracts than non-smokers (18).

The heavier the degree of smoking, the higher the risk of cataracts, in line with a previous study conducted in Kendari, Indonesia. Based on the Brinkman index, which is the result of multiplying the length of smoking and the number of cigarettes smoked in a day, it can be seen that the heavier the degree of smoking, the higher cataracts that occur (19). The previous report also shows the relationship between smoking and the incidence of senile cataracts in the Eye Clinic of Bakinang Hospital, Indonesia. Smoking history had a 7.5 times greater chance of experiencing cataracts in smoking respondents compared to non-smoking respondents. Smoking can induce oxidative stress and a decrease in ascorbate, carotenoids, and antioxidants that, over time it can cause lens turbidity (20).

Smoking can cause the build-up of chromophores. Chromophores can cause the lens to turn yellow. Cigarettes also contain cyanates which can cause carbamylation and denaturation of lens proteins. A study indicates that respondents who have a history of smoking have a high risk of developing cataracts (OR= 2.771) (21). Another report states that respondents who have a smoking habit have a 2.934 times higher risk of being diagnosed with cataracts. Smoking can damage cell membranes and lens fibers (22).

There are limitations to the study. The subjects in this study were cataract patients registered in December 2019-January 2020 so that the data obtained can be called the latest data. However, the instrument in this study was a questionnaire without periodic observation. In this study, other variables may influence the incidence of cataracts. Further research is needed to see the relationship between smoking degrees and the cataract stage. The time of initial diagnosis of cataracts to the degree of smoking can also be investigated further.

CONCLUSION

Most respondents with a heavy smoking degree suffered from cataracts at the age of 40-59 years. At the same time, most cataract patients diagnosed at ≥60 years old had mild smoking degrees and had no smoke history. The smoking degree had a significant appearance in cataract incidents on the age at cataracts diagnosed at a Private Hospital in East Java, Indonesia.

REFERENCES

1. Halasz K, Kelly SJ, Iqbal MT, Pathak Y, Sutariya V. Micro/Nanoparticle delivery systems for ocular diseases. Assay Drug Dev Technol. 2019;17(4):152-166.
2. Widiyanti P, Prastyani R. In vitro assay of cornea artificial properties. J Int Dent Med Res. 2020;13(2):769-773.
3. Ilyas S, Yulianti SR. Ilmu Penyakit Mata Edisi Kelima. Jakarta: Fakultas Kedokteran Universitas Indonesia; 2014.
4. Hutauruk DRJA, Siregar DRSR. Katarak: 101 Jawaban Atas Pertanyaan Anda. Jakarta: Gramedia Pustaka Utama; 2017.
5. Mo'otapu A, Rompas S, Bawotong J. Faktor-Faktor Yang Berhubungan Dengan Kejadian Penyakit Katarak Di Poli Mata Rsup Prof. Dr. RD Kandou Manado. J Keperawatan. 2015;3(2).
6. Fitria A. The Relationship of age, attitude, knowledge, cost to cataract surgery. J Berk Epidemiol. 2016;4(2):176-187.
7. Rochmah TN, Wulandari A, Dahlui M, Ernawaty, Wulandari RD. Cost-effectiveness analysis using disability-adjusted life years for cataract surgery. Int J Environ Res Public Health. 2020;17(16):1-10.
8. Wulandari A, Dahlui M, Ernawaty, Wulandari RD, Rochmah TN. Cost-effectiveness analysis between small incision cataract surgery and phacoemulsification. J Heal Transl Med. 2020;23:231-237.
9. Wikamorys DA, Rochmach TN. Application of the theory of planned behavior in generating patients intention to undergo cataract surgery. J Adm Kesehat Indones. 2017;5(1):32-40.
10. Aini AN, Santik YDP. Kejadian Katarak Senilis di RSUD Tugurejo. HIGEIA J Public Heal Res Dev. 2018;2(2):295-306.
11. Kemenkes RI. Infodatin: Situasi Gangguan Penglihatan dan Kebutaan. Jakarta; 2014.
12. Riorda-Eva P, Augsburger J. Vaughan & Asbury's General Ophthalmology. Ukraine: McGraw-Hill Medical; 2007.
13. Ibrahim MF. Antioksidan dan katarak. J Biomedika dan Kesehat. 2019;2(4):154-161.
14. Muliani R, Simanjuntak R, Jundiah S. Hubungan Tingkat Kebiasaan Merokok dengan Stadium Katarak Senilis di Poliklinik Katarak dan Bedah Refraktif (KBR) Rumah Sakit Mata Cicendo Bandung. J Med Heal. 2020;2(5).
15. Amelia R, Nasrul E, Basyar M. Hubungan Derajat Merokok berdasarkan Indeks Brinkman dengan Kadar Hemoglobin. J Kesehat Andalas. 2016;5(3):619-624.
16. Nadia L. Pengaruh Negatif Merokok Terhadap Kesehatan dan Kesadaran Masyarakat Urban. Universitas Terbuka; 2015.
17. Effendi IK. Prevalensi dan faktor risiko usia dan visus sebelum operasi dengan kejadian komplikasi intraoperatif pada operasi EKEK Pasien Katarak Senilis di RSUP Fatmawati Tahun 2015-2017. UIN Syarif Hidayatullah Jakarta; 2017.
18. Suparti S, Purwanti S. Analisa Faktor Risiko Pekerjaan yang Berpengaruh Terhadap Kejadian Katarak Pada Masyarakat di Sragen. J Ilmu dan Teknol Kesehat. 2017;8(2).
19. Yunaningsih A, Sahrudin S, Ibrahim K. Analisis faktor risiko kebiasaan merokok, paparan sinar ultraviolet dan konsumsi antioksidan terhadap kejadian katarak di poli mata rumah sakit umum bahteramas kendari provinsi sulawesi tenggara tahun 2017. J Ilm Mhs Kesehat Masy. 2017;2(6).
20. Hamidi MNS, Royadi A. Faktor-Faktor Yang Berhubungan Dengan Terjadinya Katarak Senilis Pada Pasien Di Poli Mata RSUD Bangkinang. J Ners. 2017;1(1):125-138.
21. Hadini MA, Eso A, Wicaksono S. Analisis Faktor Risiko yang Berhubungan dengan Kejadian Katarak Senilis Di RSU Bahteramas Tahun 2016. Medula. 2016;3(2):256-267.
22. Saputra N, Handini MC, Sinaga T. Faktor Risiko yang Mempengaruhi Kejadian Katarak (Studi Kasus Kontrol di Poliklinik Mata RSUD DR. Piringadi Medan Tahun 2017. J Ilm Simantek. 2018;2(1):104-113.