Total flight hours, irritated and burning eye and risk of mild myopia in civilian pilots in Indonesia

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Abstrak

Latar belakang: *Miopia merupakan kelainan refraksi yang sering terjadi di antara penerbang. Penelitian ini bertujuan mengidentifikasi beberapa faktor risiko dominan terhadap miopia ringan pada penerbang sipil di Indonesia.*

Metode: *Subyek adalah penerbang sipil pria berusia 21-45 tahun yang dipilih secara purposif di antara yang sedang melaksanakan pemeriksaan kesehatan berkala di Balai Kesehatan Penerbangan Jakarta. Data tajam penglihatan dan gula darah didapatkan dari rekam medik. Miopia ringan adalah subyek dengan penurunan tajam penglihatan dengan koreksi lensa -0,25 sampai dengan -0,30. Analisis data dengan regresi Cox menggunakan Stata 10.*

Hasil: *Persentase miopia ringan dalam penelitian ini sebesar 36%. Faktor risiko dominan terhadap myopia ringan adalah jam terbang total, riwayat orang tua myopia, dan gejala iritasi dan gatal mata. Subyek dengan dibandingkan dengan yang kurang dari 1000 jam terbang 28% lebih tinggi berisiko myopia ringan [risiko relatif suaian (RRa) = 1,28; 95% interval kepercayaan (CI) =1,00-1,64; P = 0,047]. Subyek dengan dibandingkan ttanpa riwayat orang tua myopia 32% lebih tinggi berisiko myopia ringan (RRa = 5,32; 95% CI = 3,75-7,55; P = 0,000. Sedangkan subyek dengan dibandingkan tanpa gejala iritasi mata 48% lebih besar berisiko miopia ringan RRa) = 1,48; 95% CI = 1,19-1,85; P = 0,001). Subyek dengan dibandingkan tanpa gejala iritasi mata 46% lebih berisiko miopia ringan (RRa = 0,46; 95% CI = 0,26-0,83; P = 0,009).*

Kesimpulan: *Jam terbang total lebih dari 1000 jam, riwayat orang tua miopia, iritasi mata merupakan faktor risiko dominan terhadap miopia ringan pada penerbang sipil di Indonesia. (**Health Science Journal of Indonesia 2016;7:49-53)***

Kata kunci: *miopia ringan, penerbang sipil, jam terbang, Indonesia*

Abstract

Background: Spatial orientation is the main problem to pilots that determined by visual, vestibuler and propioseptif. This study aims to identify several dominant risk factors related to mild myopia in civilian pilots in Indonesia.

Methods: This cross-sectional study using using purposive sampling. Subjects answered the questionaire. Data was extracted from the medical record. Cox regression analyses using Stata 10.

Results: The subject consisted of 21-45 years old male civilian pilots who performing scheduled medical check up at the Civil Aviatian Medical Centre. We found that 36% of the pilots had mild myopia, and the dominant risk factors were total flight time for 1000 hours or more, parental myopia, as well as irritated and burning eyes. Those who had compared to did have total flight hours for 1000 hours or more had 28% more risk to have mild myopia [adjusted relative risk (RRa) = 1.28; 95% confidence interval (CI) = 1.00 to 1.64; P = 0.047]. In term of parential myopia, those who had compared who did not have parential myopia had 32% more risk to have mild myopia (RRa = 1.32; 95% CI = 3.75-7.55; P = 0.000). Moreover, those who had compared to who did have irritated and burning eyes had 48% more risk to have mild myopia (RRa = 0.46; 95% CI = 0.26-0.83; P = 0.009).

Conclusions: Total flight 1000 hours or more, parental myopia, as well as irritated and burning eyes were dominant risk factors for mild myopia in civilian pilots in Indonesia. ***(Health Science Journal of Indonesia 2016;7:49-53)***

Key words: mild myopia, civilian aviator, total flight time, Indonesia.

Myopia is the most widely refractive error experienced by civilian pilotin the United States in 2004.[1] The prevalence of myopia in the USAF airmen at 21.9%.[2] Aeromedical concern for myopia is correction with glasses or contact lenses that do not fit or are not balanced will degrade stereopsis and contrast sensitivity and can also induce the onset of ocular pain and fatigue (asthenopia). Myopia also increased the risk of retinal detachment, open-angle glaucoma and retinal degenerations such as lattice.[3]

Prevalence of myopia are more frequent in individual with a history of parental myopia compared with individual who do not have myopic parents. Environmental factors that can affect the risk of mild myopia in pilots, among others, altitude, humidity, acceleration, vibration, inadequate lighting and cockpit ergonomics. Low humidity in the cabin can cause dryness and irritation of mucous membranes-especially the eyes and nasopharynx. In most commercial aircraft, the cabin pressure can be monitored but remained mild hypoxia can interfere with dark adaptation, visual field and a sharp decrease of vision and increased intraocular pressure. System in the plane due to the characteristics and limitations of existing designs, including other properties such as aircraft manuals, procedures, level of automation, control panels, alarms and warning systems, emergency systems and all existing designs.[4-6]

This study aims to identify the effect of total flight hours, age, parental history of myopia and visual fatigue symptoms on the risk of mild myopia in a civilian pilots in Indonesia

METHODS

This cross-sectional study was conducted among male civilian pilots aged 21-45 years old during periodic health examination at the Ministry of Transportation Flight Health Center in Central Jakarta. Data were collected by self-questionnaires, and the data visual acuity results of refraction was extracted from data base of the Center during the period of May 5 to 21, 2014.

Myopia is a mild decrease in visual acuity away where the light entering the meet in front of the retina. Correction of the concave lens, -0.25 s / d -3.00. (PERDAMI) best corrected visual acuity with 20/20. Normal is a subject that gets the same exposure without refractive disorders of decreased visual acuity. Examination of visual acuity using the Snellen chart for 6 meters.

Risk factors studied were total flight hours, age and visual fatigue symptoms experienced by civilian aviators. Total flight hours was divided into two subgroups: 999 hours or lessof flying hours and 1000 hours or more. Aged was divided into two groups (21-34 years and 35-45 years). Parental history of myopia divided into: yes and no.

Symptoms of visual fatigue was the inability of the visual system to maintain the effectiveness and efficiency of work or in the presence of the following signs or symptoms: dry eyes, itching, burning, pain, irritation, difficulty to focus and look for lines, blurred vision or foggy letters. For eyestrain symptoms are grouped into; not perceived, sometimes perceived, and often perceived. For visual fatigue were grouped into: not noticeable at all, somewhat noticeable, extremely noticeable.

Data analysis by Cox regression using Stata 10. Ethical approval was received from the Health Research Ethics Committee of the Faculty of medicine, University of Indonesia. This research was approved by the Head of Flight Health Ministry of Transportation.

RESULTS

The number of pilots who were willing and qualified to be the subject of as many as 336 people. Three people were excluded due to severe myopia (lens correction more than -3.00) remaining 333 study subjects consisted ot 213 subjects had normal visual acuity and 120 subjects (36%) with mild myopia.

Table 1 shows the subjects who had mild myopia were equally distributed in terms of age. OThose who had total of 1000 hours of flying hours or more had a 55% higher risk of experiencing mild myopia.

Table 2 shows that the normal subjects experienced mild myopia appears to be distributed equally in terms of visual fatigue symptoms of dry eyes, watery eyes, heaviness of eyes, shivering/jumping.

Compared with their respective respective basic comparison groups, the subjects who experienced symptoms difficulty of focusing, pain, problems with line tracking, foggy letters and eye irritation; gritty; burning more likely had more risk to experience mild myopia.

Table 1. Visual fatigue simptom and mild myopia risk

	Myopia				Crude relative risk	95% Confidence interval	P
	Normal (n=213)		Mild myopia (n=120)				
	n	%	n	%			
Age							
21-34 years	118	61.8	73	38.2	1.00	Reference	
35-45 years	95	66.9	47	33.1	0.87	0.60-1.25	0.442
Dry eyes							
Not noticeable	204	95.8	117	97.5	1.00	Reference	
Somewhat/extremely moticeable	9	4.2	3	2.5	0.69	0.21-2.15	0.519
Watery eyes							
Not noticeable	159	74.6	87	72.5	1.00	Reference	
Somewhat/extremely moticeable	54	25.4	33	27.5	1.07	0.71-1.60	0.732
Pain in or around the eyeballs							
Not noticeable	195	91.6	116	96.7	1.00	Reference	
Somewhat/extremely moticeable	18	8.45	4	3.3	0.49	0.18-1.32	0.158
Heaviness eyes							
Not noticeable	181	85	32	15	1.00	Reference	
Somewhat/extremely moticeable	106	88.3	14	11.7	0.82	0.47-1.44	0.496
Problem in tracking line							
Not noticeable	187	87.8	26	12.2	1.00	Reference	
Somewhat/extremely moticeable	95	79.2	25	20.8	1.45	0.94-2.26	0.095
Shivering/jumping							
Not noticeable	201	94.4	12	5.6	1.00	Reference	
Somewhat/extremely moticeable	116	96.7	4	3.3	0.68	0.25-1.85	0.454
Foggy letters							
Not noticeable	183	85.9	30	14.1	1.00	Reference	
Somewhat/extremely moticeable	85	70.8	35	29.2	1.70	1.15-2.52	0.008

Tabel 2. Relationship between total flight hours, parental myopia, visual fatigue symptom and risk of mild myopia

	Visual acuity				Adjusted relative risk*	95% Confidence interval	P
	Normal (n=213)		Mild myopia (n=120)				
	n	%	n	%			
Total flight hours							
150 - 999 hours	81	72.3	31	27.7	1.00	Reference	
1000 -27.000 hours	132	59.7	89	40.3	1.28	1.00-1.64	0.047
Parental myopia							
No	188	86.2	30	13.8	1.00	Reference	
Yes	25	21.7	90	78.3	5.32	3.75-7.55	0.000
Irritated and burning eye							
Not noticeable	180	84.5	113	94.2	1.00	Reference	
Somewhat/extremely moticeable	33	15.5	7	5.8	0.46	0.26-0.83	0.009

DISCUSSION

In this study, we noted that the percentage of mild myopia was 36%. Other studies on Indonesian military helicopter pilots obtained percentage of reversible myopia was 16.7%.[7] Meanwhile, previous research by the USAF shows that airmen percentage obtained subjects experienced mild myopia was 21.9%.[2] The percentage of mild myopia in the two studies were lower compared with our finding. These might be, among others, due to differences in study populations.

Other studies on civilian pilot in America in 2004 the percentage decrease in visual acuity away (Defective Distant Vision, DDV) of 38.81%.[1] comparative study has a larger number of subjects (all civilian pilotin the U.S.) with a survey method using medical records from the Civil Aerospace Medical Institute (CAMI). The percentage decrease in visual acuity away on comparative studies do not include myopia classification, so it is not known exactly what percentage of mild myopia.

In multivariate analysis, total flight hours shows the P value of 0.047. Research on military helicopter pilots do not include data on the effect of total flight hours on myopia reversible. Comparative study leading to a period of work (time of service) as the predominant risk factor. The final model studies have documented the presence of a health worker effect where pilotwith longer tenure have a lower risk of the reversible myopia.[7]

Research has not been obtained linking between flight hours and the onset of mild myopia or other refractive disorders make it difficult for authors to compare. Increased flying hours experienced civilian pilots in this study resulted in an increase in the environmental factors that influence the risk of flight of myopia, the inadequate illumination in the cockpit, the strong bright light reflection (glare), vibration and poor ergonomics.

These results indicate the risk of myopia is 5 times greater in subjects with parental myopia when compared with subjects whose parents do not myopia. In the 1996 study found a greater prevalence of myopia in individuals with parental myopia when compared with individuals whose parents do not myopia. Genetic marker that decreases myopia has not been identified.[4] It was found that before the onset of myopia, individuals with parental myopia have longer eyes.[8] A person with myopia parents have experienced a 32.9% probability of myopia than if only one parent (father or mother) that has the possibility of 18.2% and 6.3% probability when no parent myopia.[9] this study and a comparison study showed a hereditary predisposition to myopia

Based on multivariate analysis in this study, the presence of two symptoms associated with mild myopia in a civilian pilot, difficulty to focus (P = 0.001) and irritation eye,gritty or burning (P = 0.009). Bangor, 2000 states above 9 symptoms related to visual fatigue.[10]

Visual fatigue in pilotmay be associated with visual tasks while flying. Airmen perform near and far vision simultaneously. The instrument panel, weather, air pressure, humidity, and vibration will aff.ect the onset of symptoms of visual fatigue.

Vibration in aircraft instruments and printed material, especially in the range of 22-64 Hz, can significantly impair vision. Aviator in an aircraft must maintain visual acuity in two conditions - when observing conditions outside the plane and while reading the display in the instrument or in the cockpit equally being vibrated. Linear motion between the eye and the instrument panel will cause motion in the retinal image and reduce visual acuity.[11]

The results of the study Watten and Lie, 1992 indicates the convergence miopisasi and fatigue (fatigue Vergence) under the influence of continuous visual work; showed significant changes in visual acuity, refraction and myopia that leads to a decrease in the capacity of accommodation and convergence.[12]

The instrument panel in the cockpit is one of the environmental risk factors that may affect the onset of myopia in a civilian pilot. The development of technology can improve the ability of pilots to feel and see the surrounding environment; This enhancement includes panels on top of the head (head-up displays/ HDU), panel-track flight (flight-path displays), night goggles (night vision goggle), artificial vision system (syntetic-vision system) and panel-retinal laser (laser-retinal displays). Flights to use manual instruments (instrument flight /instrument flight rules /IFR) or using visual cues (visual flight/visual flight rules/VFR). Read instrument panel and flight status information is very different from the fly by using a visual perception of the environment. Displacement of the instrument flew into a visual landing can cause disorientation due to sudden changes in attention.[6]

In this study assessment needs to consider the possibility of a bias there because the flight

environment is not measured against the risk factors. In addition, questions about symptoms of visual fatigue are subjective, so it can also lead to bias.

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REFERENCES

1. Nakagawara VB, Montgomery WR, et al. Changing demographics and vision restrictions in civilian pilots and their clinical implications. Aviation Space Environment Medicine. 2005:75;785 – 90.
2. Miller RE II, Woessner WM, Dennis RJ, et al. Survey of spectacle wear and refractive error prevalence in usaf pilots and navigators. Optometry and Vision Science. American Academy of Optometry. 1990;67:833-9.
3. Syoc DV, Rohde R. Refractive error, excessive (myopia, hyperopia & astigmatism) & anisometropia. USAF Waiver Guide.2013.732-9
4. Saw SM, Katz J, Schein OD, et al. Epidemiology of myopia. Epidemiologic Review. The John Hopkins University School of Hygiene and Public Health.1996:18.
5. ICAO Manual of Civil Aviation Medicine. Edisi 3. Quebec. 2012
6. Gibb R, Gray R, Scharff L. Aviation visual perception; Research, Misperception and Mishaps. Burlington: Ashgate Publishing, Ltd.2010.
7. Basuki B. Soemardoko T. Helicopter vibration and risk of reversible myopia among military aircrew. Medical Journal Indonesia. 2002:11;93-6.
8. Zadnik K, Satariano WA, Mutt DO, et al. The effect of parental history of myopia on children's eye size. JAMA 1994;46:30-2
9. Mutti DO, Mitchell GL, Moeschberger ML, et al. Parental myopia, near work, school achievement, and children's refractive error. IOVS 2002;43(12):3633-40.
10. Bangor AW. Display technology and ambient illumination influences on visual fatigue on vdt workstations. Disertation. Politechnic Virginia. 2000
11. Rainfford DJ, Gradwell DP. Ernsting's Aviation Medicine. Edisi 4. Hal. 41-52. New York AS. Edward Arnold. 2006
12. Watten RG, Lie I. Time factors in VDT-induced myopia and visual fatigue:an experimental study. Journal of human ergology. 1992:21:13-20