Total flight hours, eating fatty foods habits and risk of obesity among civil pilots in Indonesia

Retno Wibawanti,[1] Dewi Gathmyr,[2] Asrunsyah Nasution,[3] Bastaman Basuki[1]

[1] Faculty of Medicine, Universitas Indonesia
[2] Indonesian Air Force Medical Department
[3] Chief of Indonesia Institute for Aviation Medicine (Lakespra Saryanto)

Received: August 30, 2013; Revised: November 11, 2013; Accepted: November 14, 2013

Abstrak

Latar belakang: *Pilot dapat mengalami obesitas yang berkaitan dengan jam terbang total dan faktor risiko lainnya. Oleh karena itu perlu diidentifikasi kaitan jam terbang total dan faktor lainnya terhadap risiko obesitas pada pilot sipil di Indonesia.*

Metode: *Studi potong lintang ini dengan sampel purposif pada pilot di Indonesia yang melakukan pemeriksaan kesehatan berkala di Balai Kesehatan Penerbangan Jakarta 14-24 Mei 2013. Data yang dikumpulkan terdiri dari karakteristik demografi, pekerjaan, kebiasaan makan dan olahraga, tinggi dan berat badan. Pengambilan data dilakukan dengan wawancara dan pemeriksaan fisik. Klasifikasi indeks massa tubuh berdasarkan standar WHO untuk obesitas. Analisis menggunakan regresi Cox dengan waktu yang konstan.*

Hasil: *Di antara 612 pilot berusia 19-61 tahun, diperoleh 112 subjek yang terdiri dari 33 obes dan 79 subjek normal. Faktor-faktor dominan yang berkaitan dengan obesitas adalah jam terbang total dan kebiasaan makan makanan berlemak. Berdasarkan waktu jam terbang total, pilot yang memiliki jam terbang total 2000-24361 jam dibandingkan dengan yang 60-1999 jam memiliki risiko obesitas 3,8 kali lipat [risiko relatif suaian (RRa) = 3,83; P = 0,000]. Selanjutnya, dibandingkan dengan pilot yang tidak memiliki kebiasaan makan makanan berlemak, mereka yang mempunyai kebiasaan makan makanan berlemak memiliki risiko obesitas 2 kali lipat [RRa = 2,03; 95% interval kepercayaan (CI) = 0,95-4,29; P = 0,064].*

Kesimpulan: *Jam terbang total 2000 jam atau lebih dan kebiasaan makan makanan berlemak mempertinggi risiko obesitas di antara pilot laki-laki sipil di Indonesia.* ***(Health Science Indones 2013;2:55-8)***

Kata kunci: *obesitas, jam terbang total, makanan berlemak, pilot sipil, Indonesia*

Abstract

Background: Obesity in pilots may be related to total flight hours and other risk factors. This study aimed to identify the relationship between total flight hours and other factors to obesity in civil pilots in Indonesia.

Methods: A cross-sectional study was done with purposive sampling among pilots in Indonesia undergoing periodic medical check up in 14-24 May at Aviation Medical Center Jakarta. Data collected were several demographic and work characteristics, eating habits, exercise habits, height, and weight. Data were collected by interview and physical examination. Subjects were classified normal and obese according to the WHO standard for obesity. Analysis was carried out by Cox regression with constant time.

Results: There were 612 pilots undergoing the periodic medical check up, aged 19-61 years. For this analysis were available 112 male subjects, consisting of 33 obese pilots and 79 with normal body weight. Total flight hours and eating fatty food habit were dominant risk factors for obesity. Pilots who had 2000-24361 total flight hours compared with who had 60-1999 hours had 3.8-fold risk to be obese [adjusted relative risk (RRa) = 3.83; P = 0.000]. Furthermore, compared with pilots who did not have eating fatty food habit, those who had eating fatty food habit had 2-fold risk to be obese pilot [RRa = 2.03; 95% confidence interval (CI) = 0.95-4.29; P = 0.064].

Conclusion: Total flight hours for 2000 or more and eating fatty foods habits increased the risk of obesity among male civilian pilot in Indonesia. ***(Health Science Indones 2013;2:55-8)***

Key words: obesity, total flight hours, fatty food, civil pilots, Indonesia

Corresponding author: Retno Wibawanti
E-mail: retno.wibawanti@yahoo.com

Obesity is one of health conditions which can cause incapacitation for pilots. Obesity is a multifactorial disease due to an imbalance between food consumed and physical activity. Obesity can also be associated to several health conditions such as diabetes mellitus (DM), stroke, cardiovascular diseases, and musculoskeletal diseases, such as osteoarthritis.[1-3]

In aviation, in addition to the habits of irregular eating and lack of physical activity, total flight hours can be related to obesity.[4] A study of 580 Chinese civil aircrew, aged 21-59 years with a total of 1200-29000 flight hours revealed high body mass index (BMI) and a total of 15000 flight hours or more significantly increased the risk of obesity in aircrew.[5]

In the preliminary study carried out at the Aviation Medical Center in Jakarta revealed that 37.5% (61 pilots out of 171 pilots) were obese.

This study aimed to identify total flight hours and other factors and risk of obesity among civil pilots in Indonesia.

METHODS

This was a cross-sectional study with purposive sampling at the Aviation Medical Center of the Ministry of Transportation from May14-24, 2013. Examinations were carried out during working hours (8.00 to 11.30 AM) on pilots undergoing periodic medical check-ups.

Data regarding age, sex, race, marital status, level of education, rank, duration of employment, total flight hours, and eating habits were obtained by interview with the pilots using forms specially created for this study. Data on height, and weight were obtained from physical examination results using calibrated body weight scale, height measuring tape.

Body mass index based on the WHO standard for obesity.[6] A pilot was obese if his BMI was 25 or more for Asians, and 30 or more for Caucasians; a pilot was normal BMI was 18.5-22.9.

Total flight hours were obtained from respective log book pilots, and classified into 2 groups: 60-1999 hours and 2000-24361 hours. Pilot qualification was categorized according to licenses which were: SPL = student pilot license; PPL = private pilot license; CPL = commercial pilot license; ATPL = airline transport pilot license.

Relative risk was analyzed by Cox regression with constant time.[7] Stata version 9 was used for statistical analysis. A risk factor with a P-value < 0.25 considered as a potential candidate for multivariate analysis.[8]

Ethical clearance was obtained from the Health Research Ethic Committee of the Faculty of Medicine, Universitas Indonesia. This study was undertaken after approval was granted by the Chief of the Aviation Medical Center in Jakarta.

RESULTS

During the 10 days of data collection, 612 pilots underwent periodic medical check-ups. However, 193 pilots participated this study. Two female pilots and 79 subjects who had BMI less than 18.5 or BMI 25-29.9 were excluded, leaving 112 subjects for this analysis.

Table 1 shows that obese pilots and normal pilots were similarly distributed in terms level of education and rank.

Compared with their respective reference groups, those who were 34-61 years old, and 11-40 years of total length of employment more likely had higher risk to be obese pilot.

Table 2 shows that only 4.5% (5 out of 111) pilots who had appropriate exercise habits. Obese and normal pilots were similarly distributed in terms level of breakfast habits. Those who had than did not have family history of more likely had increased the risk of obesity.

Table 3 (our final model) shows that total flight hours and eating fatty food habit were dominant risk factors related to obese pilot.

In terms of total flight hours, pilots who had 2000-24361 total flight hours compared with those who had 60-1999 hours had 3.8-fold risk to be obese pilot [adjusted relative risk (RRa) = 3.83; P = 0.000). Furthermore, compared with pilots who did not have habit of eating fatty food, those who had habit of eating fatty food had 2-fold risk to be obese [RRa = 2.03; 95% confidence interval (CI) = 0.95-4.29; P = 0.064].

DISCUSSION

This study had several limitations, among others, the subjects were purposive selected and there was the possibility of recall bias concerning eating habits.

This study revealed that pilots who had 2000-24361 total flight hours compared with those who had 60-1999 hours had 3.8-fold risk to be obese pilot. Similar study among 580 male pilots in China, aged 21-59 years with total flight hours 1200-29000 hours revealed that BMI of aircrews with total flight hours above 15000 hours increased obese significantly. Total flight hours may influence obesity, it is associated with the exposure of gamma ray to the aircrew, since it may cause lipid peroxidation.[5]

Table 1. Several demographic, work characteristics and risk of obese

	Body mass index				Crude relative risk	95% confidence interval	P
	Normal (n=79)		Obese (n=33)				
	n	%	n	%			
Age group							
19-33	56	87.5	8	12.5	1.00	Reference	
34-61	23	47.9	25	52.1	4.16	1.87-9.23	0.000
Marital status							
Not married	51	83.6	10	16.4	1.00	Reference	
Married	28	54.9	23	45.1	2.75	1.30-5.77	0.008
Level of education							
Senior high school	43	65.1	23	34.8	1.00	Reference	
College	14	77.8	4	22.2	0.64	0.22-1.84	0.406
Undergrad	19	79.2	5	20.8	0.59	0.23-1.57	0.297
Post graduate	3	75.0	1	25.0	0.72	0.09-5.31	0.745
Rank							
Private pilot license	7	87.5	1	12.5	1.00	Reference	
Commercial pilot license	54	81.8	12	18.2	1.45	0.19-11.12	0.719
Airline transport pilot license	18	47.4	20	52.6	4.21	0.56-31.37	0.161
Total duration of employment							
1-10 years	65	81.2	15	18.7	1.00	Reference	
11-40 years	14	43.7	18	56.2	3.00	1.51-5.95	0.002

Table 2. Habits of eating, exercise, family history of obesity and risk of obesity

	Body mass index				Crude relative risk	95% confidence interval	P
	Normal (n=79)		Obese (n=33)				
	n	%	n	%			
Breakfast habit							
No	20	64.5	11	35.5	1.00	Reference	
Yes	59	72.8	22	27.2	0.76	0.37-1.57	0.469
Exercise habit							
Inappropriate	74	69.2	33	30.8	1.00	Reference	
Appropriate	5	100.0	0	0	n/a	-	-
Family history of obesity							
No	72	74.2	25	25.7	1.00	Reference	
Yes	7	46.7	8	55.3	2.06	0.93-4.58	0.073

n/a = not applicable

Table 3. The relationship between total flight hours, habit of eating fatty food and risk of obesity

	Body mass index				Adjusted relative risk	95% confidence interval	P
	Normal (n=79)		Obese (n=33)				
	n	%	n	%			
Total flight hours							
60-1999	51	87.9	7	12.1	1.00	Reference	
2000-24361	7	51.8	26	48.2	3.83	1.81-8.08	0.000
Eating fatty food habit							
No	31	83.8	6	16.2	1.00	Reference	
Yes	6	64.0	27	36.0	2.03	0.95-4.29	0.064

*Adjusted between the two variables in this table

Cosmic radiation is formed by several types of ionizing radiation from external sources to our planet, which interact with the Earth's magnetic field. The intensity of cosmic radiation at higher altitude is greater than that at lower altitude.[9] The annual maximum dose received by a person is 1 mSv as recommended by ICRP (International Commission on Radiological Protection). Aircrews as personnel occupationally exposed to ionizing radiation, may not exceed 6 mSv per annum.[9]

A study which was performed by collecting 218 data flight over a period of two years of Flight Test Special Group revealed that maximum cosmic radiation dose received by aircrews was 0.02 μSv-7.46 μSv. However, aircrews with longer duration of flight and altitude may reach 8 μSv per flight. This condition implies the possibility of exceeding the annual limit recommended by ICRP.[10]

Furthermore, this study noted that pilots who had more total flight hours had higher risk being obese. This condition might be related to free radical reactions generated after radiation exposure.

Free radical reactions generated after radiation exposure can initiate self-propagating chain reactions that may lead to lipid peroxidation. Lipid peroxidation is a process which free radicals remove electrons from lipids, producing reactive intermediates that can undergo further reaction. Lipid peroxidation takes place in three steps, which are initiation, propagation and termination. The end product of this reaction is 4-hidroxynonenal (4-HNE). This 4-HNE was formed by linoleic acid and arachidonic acid when free radicals attack lipids membrane. Excessive production of 4-HNE might be sufficient to cause obesity. In a study of human subjects, the level of 4-HNE would increase significantly after consumption of an energy-dense-high-fat diet (fast food) regularly. These two studies suggested the role for 4-HNE in causing obesity.[11,12]

In addition exposure to radiation may also impact to obesity. To prevent this lipid peroxidation, it is recommended to take supplement of vitamin E which have been known as a strong antioxidant, that can decrease the lipid peroxidation and improve total antioxidant capacity in the human body.[13]

It can be concluded that total flight hours for 2000 or more and eating fatty foods habits increased the risk of obesity among male civilian pilot in Indonesia.

Acknowledgments

The authors wish to thank all subjects who cooperatively participated in this study. We would like also to express our gratitude to Dr. Thamrin Abudi who allowed us to conduct the study at Aviation Medical Center Jakarta.

REFERENCES

1. Mitchel SJ, Evans AD. Flight safety and medical incapacitation risk of airline pilots. Aviat Space Environ Med. 2004;75:260-8.
2. Gee M, Mahan LK, Escott-Stump E. Weight management. In: Mahan LK, Escott-Stump E, editors. Krause's food nutrition and therapy second ed. Missouri: Saunders Elseviers; 2008. p. 532-57.
3. Sowers MR, Karvonen-Guiterrez CA. The evolving role of obesity in knee osteoarthritis. Curr Opin Rheumatol. 2010;22:533-7.
4. Na Y, Hua L R, Mei LF. Investigation of nutritional status and KAP survey among the aircrew of civil aviation in Hunan. Practical Preventive J. 2011;9:8-11.
5. Huang H, Liu J, Feng Y, et al. The distribution of apolipoprotein E gene polymorphism in Chinese civil aircrews, and a possible risk factor to their overweight and dyslipidemia is cumulative flight time. Clin Chemical Acta. 2013;416:36-40.
6. World Health Organization. Strategy for the prevention of obesity: Defining obesity. Geneva: The Organization; 2000.
7. Barros AJD, Hirakata VN. Alternative for logistic regression in cross-sectional studies: an empirical comparison of models that directly estimates the prevalence ratio. BMC Medical Research Methodology. Oct. 2003;3(21).
8. Hosmer DW, Lemeshow S. Applied logistic regression. 2nd Ed. New York: Jhon Wiley and Sons. 2000.
9. Federico CA, de Castilho Pereira HH, Pereira MA, et al. Estimates of cosmic radiation dose received by aircrew of DCTA's flight test special group. J Aerosp Technol Manag. 2010;2:137-44.
10. STUK authority. Finland radiation and nuclear safety authority. Guide of radiation safety in aviation. Investigation of radiation exposure due to cosmic radiation. The authority: Helsinki; 2005.
11. Kiang JG, Fukumoto R, Gorbunov NV. Lipid peroxidation after ionizing radiation leads to apoptosis and autophagy. In: Angel Catala, editor. Biochemistry, genetics and molecular biology. Maryland: Uniformed Service University of Health Sciences; 2012. p. 263-278.
12. Mattson MP. Roles of the lipid peroxidation product 4-hydroxynonenal in obesity, the metabolic syndrome, and associated vascular and neurodegenerative disorders. Exp Gerontol. 2009;44:625-33.
13. Amani AR, Somchit MN, Konting MMB, et al. Vitamin E and curcumin interventionon lipid peroxidation and antioxidant defense system. J of American Science. 2010;6:52-62.