Flight hours, habit of eating sweet foods and the risk of hyperglycemia in civilian pilots in Indonesia

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Abstrak

Latar belakang: *Hiperglikemi antara lain dapat menyebabkan komplikasi penyakit kardiovaskular yang dapat mengganggu kinerja seorang pilot sipil dalam keselamatan penerbangan. Tujuan penelitian ini ialah mengidentifikasi beberapa faktor yang berperan terhadap risiko hiperglikemi.*

Metode: *Subjek penelitian pada penelitian potong lintang ini dipilih secara purposif di antara pilot sipil laki-laki yang melakukan pemeriksaan kesehatan berkala di Balai Kesehatan Penerbangan (Balhatpen) Jakarta pada 28 Mei - 9 Juni 2013. Data demografi, kebiasaan, dan pekerjaan diperoleh dengan wawancara. Data kadar glukosa darah puasa (GDP) berasal dari laboratorium Balhatpen. Hiperglikemi jika kadar GDP 100-125 mg/dl, dan GDP normal adalah 70-99 mg/dl.*

Hasil: *Selama 10 hari pengumpulan data terdapat 612 pilot sipil, 225 orang menjadi subjek penelitian, dan 31,2% di antaranya dengan hiperglikemi. Pada penelitian ini ditemukan 2 faktor dominan yaitu rerata jam terbang per tahun dan kebiasaan makan makanan manis yang mempertinggi risiko hiperglikemi. Pilot dengan rerata 1051-1130 jam terbang per tahun dibandingkan dengan 25 sampai 1050 jam per tahun berisiko 85% lebih tinggi hiperglikemia [risiko relatif suaian (RRa) = 1,85; P = 0,003]. Pilot sipil dengan kebiasaan makan makanan manis setiap hari dibandingkan dengan 0-4 kali/minggu berisiko 2 kali lipat hiperglikemia (RRa = 2,09; P = 0,002)*

Kesimpulan: *Pilot sipil yang dengan rerata 1051-1130 jam terbang per tahun atau mempunyai kebiasaan makan makanan manis setiap hari mempunyai risiko lebih tinggi mengalami hiperglikemia.* ***(Health Science Indones 2014;1:-)***

Kata kunci: *hiperglikemi, jam terbang, kebiasaan makan, pilot sipil, Indonesia*

Abstract

Background: Hyperglycemia can lead to long-term complications such as cardiovascular disease that might interfere the performance of civilian pilot. This study aimed to identify the factors that contribute to the risk of hyperglycemia.

Methods: The subjects of this cross-sectional study consisted of purposively selected male civilian pilots who underwent periodic medical check-up at the Aviation Medical Center in Jakarta on May 28 to June 9, 2013. Data on demographic, eating habits, and employment were collected through interviews. Data on fasting blood glucose levels was taken from the Center's laboratory report. Hyperglycemia was defined as fasting blood glucose levels of 100-125 mg/dl, while fasting blood glucose levels of 70-99 mg/dl was normal.

Results: During the 10 days of data collection there were 612 pilots, with 225 pilots willing to participate in this study. This study reveals 31.2% civilian pilots had hyperglycemia. Average flight hours per year and habit of eating sweets every day were dominant factors related to the risk of hyperglycemia. Those who had 1051 to 1130 hours than 25 to 1050 hours flight hours per year had almost 85% increase risk to be hyperglycemic [adjusted relative risk (RRa) = 1.85; P = 0.003]. Furthermore, those with the habit of eating sweet food everyday compared to 0 to 4 times per week had a 2-fold increased risk to be hyperglycemic (RRa = 2.09; P = 0.002).

Conclusion: Average flight hours of 1051 to 1130 hours per year and the habit of eating sweet foods every day increased the risk of hyperglycemia. ***(Health Science Indones 2014;1:-)***

Key words: hyperglycemia, flight hours, eating habits, civilian pilot, Indonesia

Several studies found that the prevalence of hyperglycemia increased every year throughout the world. The numbers of patients with hyperglycemia is currently estimated to be around 314 million people worldwide and will increase to 418 million by 2025.[1] Furthermore, according to the World Health Organization (WHO) data, the incidence of hyperglycemia in Indonesia increased in 2009.[2] Hyperglycemia, which may also occur among civilian pilots, may cause long-term complications, such as cardiovascular diseases leading to incapacitation impairing performance of the pilots.[3]

Several factors are related to hyperglycemia. A previous study in Brazil of 214 subjects aged over 35 years showed that elevated fasting blood sugar levels were related to the type of diet (healthy, western, and traditional). The western diet had 1.5-fold more risk to elevated levels of blood glucose.[4,5]

Preliminary study at the Aviation Health Center, Jakarta on February 2012 revealed that 32.2% among 279 civilian pilots had hyperglycemia. This study aimed to identify the relationship between flight hours, habit of eating sweet foods and hyperglycemia among civilian pilots in Indonesia.

METHODS

The subjects for this cross-sectional study consisted of purposively selected civilian pilots who underwent periodic medical check-ups on May 28 to June 9, 2013 at the Aviation Medical Center Jakarta. Data were obtained from interviews using a structured questionnaire and physical examinations. Data on blood glucose were extracted from the laboratory report.

For this analysis, hyperglycemia was defined as fasting blood glucose levels of 100-125 mg/dl, while normal was fasting blood glucose levels of 70-99 mg/dl.[6] Average flight hours per year were 25-1050 hours and 1051-1130 hours; habit of eating sweet foods were 0-1 day per week, 2-4 days per week, and every day.

Several confounder/effect modifiers were categorized as followed: age (19-39 years, 40-50 years, 51-65 years); race (Asian, Caucasian); total flight hours (60-4999, 5000-14999, 15000-29831); smoking habits (never/past, current); eating habits (eating white rice, eating fatty food, drinking sweet tea, drinking sweet coffee, drinking alcohol, eating white bread for 0-1 day per week, 2-4 days per week, or every day); exercise (never, not appropriate, appropriate).

To calculate relative risk for hyperglycemia, relative risk (RR) using Cox regression with constant time was used. The STATA version 9 was used for the calculation.[7]

Ethical approval was obtained from the Research Ethical Commission of the Faculty of Medicine Universitas Indonesia. The study was undertaken with approval of the Chief of the Aviation Medical Centre.

RESULTS

There were 612 pilots aged 18 to 61 years who underwent medical check-up during the 10 days study period. However, only 239 pilots were willing to participate in this study. Fourteen student pilots were excluded for analysis, leaving 225 subjects for this analysis. There were 155 pilots with normal fasting blood glucose and 70 pilots (32.1%) with hyperglycemia. None of the subjects were on medication.

Table 1 showed that the pilots who had normal and hyperglycemia fasting blood glucose were similarly distributed with respect to age and race. Civilian pilots with total flying hours 15000 to 29831 hours compared with 60 to 4999 hours had an increased risk for hyperglycemia.

Table 2 showed that pilots with normal and hyperglycemia fasting blood glucose were similarly distributed with respect to smoking status, habit of eating white rice, eating fatty foods, drinking sweet coffee, drinking alcohol, and exercise. Pilots who with a habit of drinking sweet tea every day compared with 0 to 4 per week more likely had an increased risk to be hyperglycemic.

Table 3 showed that two dominant factors (average flight hours per year and habit of eating sweet foods every day) were related to the risk of hyperglycemia.

Compared to those who had average flight hours per year of 25 to 1050 hours, those who with 1051 to 1130 hours per year had 85% increased risk to be hyperglycemic. Furthermore, the habit of eating sweets food every day compared with 0-1 day per week had 2-fold increased the risk of hyperglycemia.

DISCUSSION

There were several limitations of this study. The pilots did not directly interviewed. The data were obtained by self-answered questionnaires. In addition, the quantity of their food and drink was not measured.

Table 1. Several socio-demographic characteristics and the risk of hyperglycemia

	Fasting blood glucose				Crude relative risk	95% Confidence Interval	p
	Normal (n=155)		Hyperglycemia (n=70)				
	n	%	n	%			
Age							
19-39 years	118	69.8	51	30.2	1.00	Reference	
40-50 years	26	68.4	12	31.6	1.04	0.55-1.96	0.887
51-65 years	11	61.1	7	38.9	1.28	0.58-2.83	0.529
Race							
Asian	140	70.0	60	30.0	1.00	Reference	
Caucasian	15	60.0	10	40.0	1.33	0.68-2.60	0.400
Total flight hours							
60-4999	95	70.9	39	29.1	1.00	Reference	
5000-14999	51	69.9	22	30.1	1.03	0.61-1.74	0.896
15000-29831	9	50.0	9	50.0	1.71	0.83-3.54	0.143

Table 2. Several habits and the risk of hyperglycemia

	Fasting blood glucose				Crude relative risk	95% Confidence Interval	p
	Normal (n=155)		Hyperglycemia (n=70)				
	n	%	n	%			
Smoking							
Never/former smoker	82	66.7	41	33.3	1.00	Reference	
Current smoker	73	71.6	29	28.4	0.85	0.53- 1.37	0.512
White rice							
0-1 day per week	9	69.2	4	30.8	1.00	Reference	
2-4 days per week	26	70.3	11	29.7	0.96	0.30- 3.03	0.953
Every day	120	68.6	55	31.4	1.02	0.37- 2.81	0.967
Eating fatty food							
0-1 day per week	33	63.5	19	36.5	1.00	Reference	
2-4 days per week	67	67.7	32	32.3	0.88	0.50-1.56	0.672
Every day	55	74.3	19	25.7	0.70	0.37-1.32	0.277
Drinking sweet tea							
0-1 day per week	51	77.3	15	22.7	1.00	Reference	
2-4 days per week	37	67.3	18	32.7	1.44	0.72-2.85	0.297
Every day	67	64.4	37	35.6	1.56	0.85-2.85	0.143
Drinking sweet coffee							
0-1 day per week	72	75.8	23	24.2	1.00	Reference	
2-4 days per week	25	69.4	11	30.6	1.26	0.61-2.58	0.525
Every day	58	61.7	36	38.3	1.58	0.93-2.66	0.086
Drinking alcohol							
0-1 day per week	145	68.4	67	31.6	1.00	Reference	
2-4 days per week	9	81.8	2	18.2	0.57	0.14-2.34	0.441
Every day	1	50.0	1	50.0	1.58	0.21-11.39	0.649
Eating white bread							
0-1 day per week	44	81.5	10	18.5	1.00	Reference	
2-4 days per week	61	71.8	24	28.2	1.59	0.73-3.43	0.234
Every day	50	58.1	36	41.9	1.94	0.91-4.16	0.085
Exercise							
Never	90	68.7	41	31.3	1.00	Reference	
Not appropriate	55	69.6	24	30.4	0.97	0.58- 1.60	0.908
Appropriate	10	66.7	5	33.3	1.06	0.42- 2.69	0.894

Table 3. The relationship between average flight hours per year, habit of eating sweet foods and the risk of hyperglycemia

	Fasting blood glucose				Adjusted relative risk*	95% confidence Interval	p
	Normal (n=155)		Hyperglycemia (n=70)				
	n	%	n	%			
Average flight hours per year							
25-1050 hours	153	70.5	64	29.5	1.00	Reference	
1051-1130 hours	2	25.0	6	75.0	1.85	1.24-2.78	0.003
Eating sweet foods							
0-1 day per week	91	78.4	25	21.6	1.00	Reference	
2-4 days per week	37	66.1	19	33.9	1.56	0.94-2.60	0.860
Every day	27	50.9	26	49.1	2.09	1.31-3.31	0.002

*Adjusted each other between variables listed on this Table.

There were 70 (31.2%) civilian pilots with hyperglycemia. This number was higher than in Japanese and Indian civilian pilots which found 4.4% and 6.7%, respectively, with hyperglycemia.[2,5] This was most likely due to their different lifestyles (diet, exercise).[1,5] Therefore it is important to educate our civilian pilots on prevention of hyperglycemia such as by modifications in lifestyles (control of diet, regular exercises of 3 to 4 times per week for 30 minutes).

This study revealed among civilian pilots in Indonesia, annual flight hours of 1051 to 1130 hours compared to 25 to 1050 hours increased the risk of hyperglycemia. This was similar to findings of other studies, such as in the pilots in India with 1000 hours or more flying hours there was an risk elevated levels of fasting blood glucose compared with less than 1000 hours of flying hours.[5] This may be associated with exposure to hypoxia experienced by civilian pilots at work.

Exposure to hypoxia accompanied by stress factors at work and poor eating habits can lead to insulin resistance. This resistance is caused by decreasing activity of Insulin Receptor-ß (IR-ß) and Insulin Receptor Substrate-1 (IRS-1) and the release of proinflammatory cytokines (interleukin-6 and tumor necrosis factor-α). IR-ß and IRS-1 is a protein that signals insulin secretion.[8-11] Therefore recommendations for the airlines need to be given on the effects and dangers of long-term hyperglycemia for pilots and the importance of regulating flying hours.

Another risk factor for hyperglycemia was the habit of eating sweet foods every day. The results were similar to a study in the United States on 3157 adults. The consumption of sweet foods every day increased the risk of abnormalities in glucose homeostasis and insulin resistance.[12] Therefore recommendations of planning as well as the portions of foods for Indonesian civilian pilots while working should be made.

In conclusion, annual flight hours of 1051 to 1130 hours, and the habit of eating sweet foods every day increased the risk of hyperglycemia in Indonesian civilian pilots.

Acknowledgments

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