A Comparative Study of Plasma Fibrinogen among Hookah Smokers, Cigarette Smokers and Non-Smokers

Seyyed Hashem Sezavar, MD; Ali Abedi, MSc; Homayoun Sadeghi Bazargani, MD

Abstract

Background- Although over the last decade smoking rates have decreased, hookahs seem to have proved increasingly popular in some eastern countries. It has been demonstrated that smoking increases the plasma fibrinogen level, which is an independent risk factor for cardiovascular disease. Our objective was to investigate the extent to which hookah smokers in comparison with cigarette smokers and non-smokers have their fibrinogen level increased.

Methods- In this comparative analytic study, 450 men aged 20-75 years old were enrolled (150 hookah smokers, 150 cigarette smokers and 150 non-smokers). Two ml blood samples were taken, and fibrinogen was measured by the Clauss method. Data were analyzed by SPSS11 statistical package; X^2, ANOVA and *t*-tests were used for analysis.

Results- The difference in the mean fibrinogen level among the three groups was statistically significant by one-way ANOVA test (P<0.001). Mean difference was 53.21 for hookah smokers compared with non-smokers (t=8.2, P<0.01). It was 39.47 when hookah smokers were compared with cigarette smokers (t=7.24, P<0.01). In subjects aged less than 55 years, the proportion of people with fibrinogen level included in higher tertile to lower tertile was 2 for hookah smokers, 0.16 for cigarette smokers and 0.19 for non-smokers. In subjects aged 55 or more, this proportion was calculated to be 13 for hookah smokers, 3.5 for cigarette smokers and 0.33 for non-smokers; the difference was statistically significant. The difference for being included in low tertile or not was significant for both the hookah smokers and cigarette smokers when compared separately with non-smokers. It was found that higher tertile to lower tertile proportion was 24 in those who smoked hookahs more than three times a day and in those who had smoked hookahs for 10 years or more (P<0.001). In those who had smoked hookahs for less than 10 years or less than 3 times a day, the proportion was 1.47 compared to non-smokers at 0.19.

Conclusion- Hookah smokers (especially, those smoking for more than 10 years) suffer a dramatic increase in their plasma fibrinogen in comparison with cigarette smokers and non-smokers ***(Iranian Heart Journal 2004; 5(3): 48-54).***

Key words: Plasma fibrinogen ■ smoking ■ cardiovascular disease

Tobacco is used widely in different manners for smoking and even chewing purposes. Tobacco use is closely intertwined with cultural traditions. India, Turkey and Iran are known to rank first among hookah users. Tobacco is placed into the upper bowl of the hookah underneath the hot charcoal. The resultant smoke passes through the water-filled water bulb of the hookah to the mouth piece, usually by a flexible tube. For all the declining rates of cigarette smoking over the last decade, hookahs have enjoyed an increasing popularity in Iran, especially

Correspondence to: Homayoun Sadeghi, MD, MPH, Deputy for Research, Ardabil Provincial Health Department, Ardabil University of Medical Sciences, Shohada Ave., Ardabil, Iran Postal code: 56157-51147 E-mail: homayounsb@yahoo.com Tel: +984517710230 Fax: +984517713386

among the youth.[1, 2] Tobacco smoking gives rise to about 3.5 million deaths per year. It is responsible for more than 25 distinct diseases.[3]

Some effects of hookah usage on body health have been mentioned in previous studies. It has been shown that hookah smoking, in addition to causing low birth weight when used during pregnancy,[4] accounts for obstructive lung disease and decratocanthoma and cancer of the lips.[5] Any kind of smoking can increase the hematocrit and can, by increasing the blood viscosity, finally lead to cardiac hypertrophy and other cardiovascular diseases.

There is little information about the comparative role of hookah smoking and cigarette smoking in increasing plasma fibrinogen. Plasma fibrinogen is a major determinant of platelet aggregation and blood viscosity, and its role in cardiovascular disease has been mentioned in previous studies.[6-10] It has been concluded in some other studies that fibrinogen is an independent risk factor for cardiovascular disease. We designed and conducted a cross-sectional comparative study to find out the extent to which hookah smokers in comparison with cigarette smokers and non-smokers have their fibrinogen level increased.

Methods

In this comparative analytic study, 450 men aged 20-75 years old were enrolled. 150 of them, chosen from tea bars serving hookahs, had at least a recent three-year long continuous history of hookah smoking. A second comparison group, consisting of 150 cigarette smoking men of the same age range, was selected from either the tea bars or the same geographical areas from which the hookah smokers came. The third group was comprised of non-smoking men chosen similarly. A short questionnaire for each participant having been completed, a 2 ml blood sample was taken and sent immediately and randomly to two reputable clinical laboratories. The hematocrit measurement was done by a routine method; and fibrinogen was measured by the Clauss method, using a test kit domestically-produced by (Mahsayaran). Data were fed into a computer for analysis by SPSS statistical package. χ^2 and one way ANOVA and *t*-tests were used to analyze the data.

Results

There was no statistical difference in the mean age of the groups compared. Overall mean age was 0.6 ± 14.7 (mean $\pm$ SD). Plasma fibrinogen level was different in the three groups (Fig. 1, Table I). The difference was found to be statistically significant by one-way ANOVA test ($P<0.001$, $F=40$). Mean difference between dual groups was tested by independent *t*-test. It was 13.74 when the cigarette smokers and non-smokers were compared ($t=2.12$, $P=0.035$). Mean difference was 53.21 for hookah smokers compared with non-smokers ($t=8.2$, $P<0.01$). It was 39.47 when the hookah smokers were compared with the cigarette smokers ($t=7.24$, $P<0.01$).

Table I: Descriptive indices of plasma fibrinogen among hookah smokers, cigarette smokers and non-smokers.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Non-smokers	150	213.0400	63.5616	5.1898	202.7849	223.2951
Cigarette Smokers	150	226.7800	47.5176	3.8798	219.1135	234.4465
Hookah smokers	150	266.2533	46.8804	3.8278	258.6896	273.8171

We compared the fibrinogen levels in the three above-mentioned groups in accordance with the normal population tertiles given by precious studies. The distribution was statistically different among the groups, even when adjusted for age (P<0.001).

In subjects aged less than 55 years, the higher tertile to lower tertile proportion was 2 for hookah smokers, 0.16 for cigarette smokers and 0.19 for non-smokers. In subjects aged 55 or more, this proportion was calculated to be 13 for hookah smokers, 3.5 for cigarette smokers and 0.33 for non-smokers (Table II).

Table II: Distribution of hookah smokers, cigarette smokers and non-smokers in lower, middle and upper tertiles of plasma fibrinogen

Age Group 1 : Under 55 yrs			**Fibrinogen Level**			Total
			104 - 217	217 - 278	278 - 377	
SMOKING Type	Non-smokers	Count	**91**	**14**	**18**	**123**
		% within SMOKING Type	74.0%	11.4%	14.6%	100.0%
	cigarette smokers	Count	**68**	**56**	**11**	**135**
		% within SMOKING Type	50.4%	41.5%	8.1%	100.0%
	Hookah smokers	Count	**21**	**64**	**42**	**127**
		% within SMOKING Type	16.5%	50.4%	33.1%	100.0%
Total		Count	180	134	71	385
		% within SMOKING Type	46.8%	34.8%	18.4%	100.0%
Pearson Chi-Square = 98.1 & Asymp. Sig. (2-sided) = .000						
Age Group 2 ; equal to or more than 55 yrs			**Fibrinogen Level**			Total
			104 - 217	217 - 278	278 - 377	
SMOKING Type	Non-smokers	Count	**18**	**3**	**6**	**27**
		% within SMOKING Type	66.7%	11.1%	22.2%	100.0%
	cigarette smokers	Count	**2**	**6**	**7**	**15**
		% within SMOKING Type	13.3%	40.0%	46.7%	100.0%
	Hookah smokers	Count	**1**	**9**	**13**	**23**
		% within SMOKING Type	4.3%	39.1%	56.5%	100.0%
Total		Count	21	18	26	65
		% within SMOKING Type	32.3%	27.7%	40.0%	100.0%
Pearson Chi-Square = 25.5 & Asymp. Sig. (2-sided) = .000						

We carried out the aforementioned statistical tests for tertiles calculated from our study's fibrinogen results. Similarly, there was a statistically significant difference, and the hookah smokers had a higher chance to be in a higher tertile (P <0.001).

Dual comparisons were made between the groups to determine whether or not they were in higher tertiles. There was a statistically significant difference when the hookah smokers and cigarette smokers were compared and, similarly, when the hookah smokers and non-smokers were compared. No statistical difference was shown between the cigarette smokers and non-smokers so as for them to be included in high tertile fibrinogen group, although the power of study was 0.956 (for α = 0.05). Nevertheless, the difference for being included in low tertile or not was significant for both the hookah smokers and cigarette smokers when compared separately with non-smokers.

Pearson correlation coefficient was 0.359 between the number of years of hookah smoking and plasma fibrinogen (p=0.000). It was 0.23 between the daily frequency of hookah smoking and plasma fibrinogen (p=0.005). We found the coefficient to be 0.46 between the number of years of smoking and daily frequency of hookah smoking (p<0.001). We subsequently adjusted the difference of being included in high tertile fibrinogen group between the hookah smokers and non-smokers for having a long history of hookah smoking and daily frequency of hookah smoking. It turned out that the higher tertile to lower tertile proportion was 24 in those smoking hookahs more than three times a day and in those smoking hookahs for 10 years or more (P<0.001). Compared to non-smokers who had a 0.19 proportion, it is a very high rank. In those smoking hookahs for less than 10 years or less than 3 times a day, the proportion was 1.47 compared to non-smokers at 0.19.

Iranian hookah smokers seem to have a preference for specific kinds of tobacco, not least Isfahan tobacco. On account of wide confidence intervals, the role of hookah tobacco in plasma fibrinogen is not discussed in this study, although the lowest level belonged to fruity tobaccos which have became popular over the last decade.

The mean and standard deviation for the hematocrit level was found to be 43.33 ± 4.3 for the non-smokers, 43.34 ± 2.5 for cigarette smokers and 45.91 ± 4.2 for hookah smokers. No linear relation was seen between hematocrit and plasma fibrinogen.

Discussion

Our study revealed that the mean plasma fibrinogen level was significantly different in all the three groups of non-smokers, cigarette smokers and hookah smokers. Previous studies have demonstrated that the fibrinogen level increases with age;[11] however, given that the mean age was not different among the groups in our study, we assume that the mean plasma fibrinogen difference observed among the groups is real.

There are some studies confirming the role of smoking in increasing the fibrinogen level.[12,13,14,15] Folsom in an article has considered smoking as the most important lifestyle correlate of fibrinogen.[14]

In our study, we found a dose-related increase of plasma fibrinogen both in cigarette smokers and hookah smokers.

In a cross-sectional study among 1044 (male 975, female 69) employees aged 30-59 years in Japan, Takahashi et al. found that there was a dose-response relationship between cigarette smoking and plasma fibrinogen concentration.[12] Similarly, Fogari et al., in a comparative study on 708

men with essential hypertension and 944 with normal blood pressures, showed that in both groups, fibrinogen levels in cigarette smokers increased with the number of cigarettes smoked.[11] They also mentioned a direct but reversible effect for tobacco on fibrinogen.

The findings of our study showed that the effect of smoking on plasma fibrinogen, compared to non-smokers, increased with age, indicating a possible interactive effect of age on the relation between smoking and fibrinogen. Consistent with our findings are the findings of a cross-sectional population-based study on 1544 subjects (747 men, 797 women) in Spain by Nascetti et al., who concluded that age was the strongest variable associated with fibrinogen, modifying the association between smoking and fibrinogen, and that the magnitude of association increased with age.[16]

Searching the literature with related key words, we found no previous study published on the specific and separate roles of hookah smoking on fibrinogen in the form of a comparative study.

What is surprising in our study is that although both the cigarette smokers and hookah smokers had higher fibrinogen levels compared to the non-smokers, the magnitude of the increase was several times the magnitude of the increase in the cigarette smokers. The difference is more prominent in persons above 55 years of age smoking hookah for more than 10 years and three times a day or more. In this group, the chance to be included in the upper tertile of plasma fibrinogen of the community is 30 times that of the non-smokers.

The relation between fibrinogen and cardiovascular disease was first revealed in 1950.[17] Presently, there are many studies considering fibrinogen as a risk factor for cardiovascular disease.[6-10,18-20] Some studies have shown that there is a distinct relation between the fibrinogen level and cardiovascular mortality[7, 21, 20] Comparing these facts with our findings, we can conclude that smoking hookah at least five times a day for more than 10 years, especially in those above 55 years old, increases cardiac mortality separately by increasing the plasma fibrinogen. Keshavamurthy et al., in a prospective study on 192 patients admitted in an intensive coronary care unit of a large municipal hospital with final diagnosis of unstable angina, concluded that in patients with unstable angina, elevated levels of plasma fibrinogen at admission indicated an adverse in-hospital outcome and a more complex coronary morphology.[22] Many studies in Germany, USA and Sweden have shown that by measuring the base level for fibrinogen, it is possible to predict future coronary attacks. Colas et al. in their study showed that drug-induced reduction in plasma fibrinogen could reduce the rate of cardiovascular events.[23]

Comparison made between hookah smokers and non-smokers showed a statistically significant higher level of hematocrit in hookah smokers. A high hematocrit increases blood viscosity, which gives rise to a higher cardiac output and lower blood velocity.

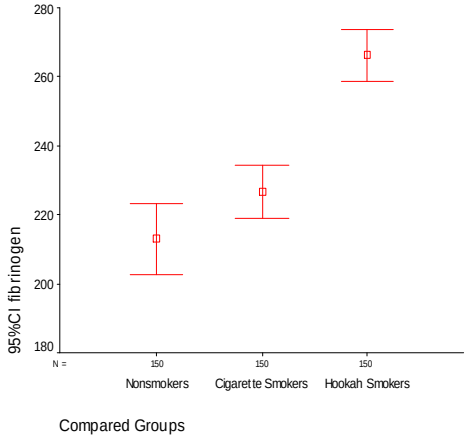

Fig. 1. Mean and confidence interval of plasma fibrinogen among hookah smokers, cigarette smokers and non-smokers.

Conclusion

Hookah smoking increases plasma fibrinogen much more than cigarette smoking does.
In light of previous research on the risk of high fibrinogen and findings of this study, we conclude that hookah smoking more than three times daily for 10 years increases cardiac mortality.

Acknowledgements

We are grateful to the Vice Chancellor of Research at Ardabil University of Medical Sciences for granting financial support to this research and Dr. Majdzadeh (epidemiologist) for his kind collaboration and recommendations.

References

1. Mohammad K. A prevalence trend of tobacco usage in Iran based on two consecutive national health surveys. Hakim Journal 2000 March; 3(4): 290-297 (Persian).

2. Majdzadeh S. A qualitative study on Hookah smoking popularity in Hormozgan province. Hakim Journal 2000 March; 3 (4): 298-304 (Persian).

3. World Health Organization. Guidelines for controlling and monitoring tobacco epidemic, 1998.

4. Nuwayhid IA, et al. Narghileh (hubble-bubble) smoking, low birth weight and other pregnancy outcomes. Am J Epidemiology 1998 Aug 15; 148(4): 375-383.

5. El-Hakim IE, et al. Squamous cell carcinoma and keratoacanthoma of the lower lip associated with Giza and Shisha smoking. Int J Dermatology 1999 Feb; 36 (2): 108-110.

6. Cantin B, Despres JP, Lamarche B, Moorjani S, Lupien PJ, Bogaty P, Bergeron J, Dagenais GR. Association of fibrinogen and lipoprotein (a) as a coronary heart disease risk factor in men (The Quebec Cardiovascular Study). American Journal of Cardiology 2002 Mar 15; 89 (6); 662-6.

7. Woodward M, Lowe GD, Rumley A, Tunstall-Pedoe H. Fibrinogen as a risk factor for coronary heart disease and mortality in middle-aged. European Heart Journal 1998 Jan; 19(1): 55-62.

8. Talks SJ, Chong NH, Gibson JM, Dodson PM. Fibrinogen, cholesterol and smoking as risk factors for non-arteritic anterior ischaemic optic neuropathy. Eye 1995; 9 (1): 85-8.

9. Folsom AR, Johnson KM, Lando HA, McGovern PG, Solberg LI, Ekstrum JK. Plasma fibrinogen and other cardiovascular risk factors in urban American Indian smokers. Ethnicity Disease 1993 Fall; 3(4): 344-50.

10. Fogari R, Zoppi A, Tettamanti F, Malamani GD, Marasi G, Vanasia A, Villa G. Fibrinogen levels in normotensive and hypertensive men: a cross-sectional study. Source Journal of Cardiovascular Risk 1994 Aug; 1(2): 149-53.

11. Takahashi S, Imaki M, Yoshida Y, Ogawa Y, Tanada S. A cross-sectional study on the relationship of plasma fibrinogen concentration and age, physical fitness, lifestyle and health examinations of healthy Japanese males. Japanese Journal of Hygiene 2000 Jul; 55(2): 508-15.

12. Scarabin PY, Vissac AM, Kirzin JM, Bourgeat P, Amiral J, Agher R, Guize L. Elevated plasma fibrinogen and increased fibrin turnover among healthy women who both smoke and use low-dose oral contraceptives - a preliminary report. Thrombosis Haemostasis 1999 Sep; 82(3): 1112-6.

13. Folsom AR. Epidemiology of fibrinogen. European Heart Journal 1995 Mar; 16 Suppl A: 21-3.

14. Eliasson M, Asplund K, Evrin PE, Lundblad D. Relationship of cigarette smoking and snuff dipping to plasma fibrinogen. Atherosclerosis 1995 Feb; 113(1): 41-53.

15. Nascetti S, Elosua R, Pena A, Covas MI, Senti M, Marrugat J. REGICOR Investigators. Variables associated with fibrinogen in a population-based study: interaction between smoking and age on fibrinogen concentration. European Journal of Epidemiology 2001; 17(10): 953-8.

16. Sharp Dan S. Plasma fibrinogen and coronary heart disease in elderly Japanese-American men. American Heart Association 1996 Feb; 16(2): 262-268.

17. von Eyben FE, Mouritsen E, Holm J, Montvilas P, Dimcevski G, Helleberg I, Kristensen L, Suciu G, von Eyben R. Smoking, low density lipoprotein cholesterol, fibrinogen and myocardial infarction before 41 years of age: a Danish case-control study. J Cardiovasc Risk 2002 Jun; 9(3): 171-8.

18. Dnesh J. Collins R, Appleby P, Peto R. Association of fibrinogen-reactive protein, albumin, or leukocyte count with coronary heart disease: meta-analysis of prospective studies. JAMA 1998 May; 279(18): 1477-1482.

19. Ernst E, Resch KL. Fibrinogen as a cardiovascular risk factor: a meta-analysis and review of literature. Annals of Internal Medicine 1993 June; 118 (12): 956-963.

20. Benderly M, Graff E, Riecher H, et al. Fibrinogen is a predictor of mortality in coronary heart disease patients. American Heart Association 1996 Mar; 16 (3): 351-356.

21. Woodward M, Rumley A, Tunstall-Pedoe H, Lowe GD. Does sticky blood predict a sticky end? Associations of blood viscosity, haematocrit and fibrinogen with mortality in the West of Scotland. Br J Haematol 2003 Aug; 122 (4): 645-50.

22. Keshavamurthy CB, Kane GR, Magdum AP, Sahoo PK. Plasma fibrinogen and C-reactive protein levels predict major adverse cardiac events in unstable angina. Indian Heart Journal 2000 Jan-Feb; 52 (1): 36-9.

23. Colas JL, Montalescot G, Tribouilloy C. Fibrinogen: a cardiovascular risk factor. Presse Medicale 2000 Nov; 29(34): 1862-6.