Status of lipids and the frequency diseases of cardiovascular origin in smokers according to the length period of smoking and a number of cigarettes smoked daily

Senaida Bišanović [1*], Bakir Mehić [2], Suad Sivić [3]

[1] Public Health Institution of Gradačac, Josip Šiber bb: 76 250 Gradačac, Bosnia and Herzegovina; [2] Clinical Centre University of Sarajevo, Clinic for Lung Diseases and Tuberculosis "Podhrastovi", Bardakčije 90; 71000 Sarajevo, Bosnia and Herzegovina; [3] Public Health Institution of Zenica, fra Ivana Jukića 2. 72000 Zenica, Bosnia and Herzegovina

Abstract

Cigarette smoking affects all phases of atherosclerosis from endothelial dysfunction to acute occlusive clinical events. The problem is, whether the length of the period of cigarette smoking has a more reflection to the status of lipids and illnesses of cardiovascular system or the bigger number of smoked cigarettes in a shorter time-period? The observed sample has constituted of two groups of smokers, both gender, age 25-64 years old. The first group consisted of 210 examinees divided in 7 subgroups according to a number of years they have been smoking. The second group consisted of 150 examinees, which was divided in 5 subgroups, according to average number of cigarettes smoked daily. The average values of serum cholesterol (6.98 *vs.* 6.13mmol/L), triglycerides (3.15 *vs.* 3.13 mmol/L) and LDL-cholesterol (3.80 *vs.* 3.64 mmol/L) were always higher in a group of smokers according to a number of daily smoked cigarettes. Average value of smoking consumption period was higher in a group of smokers according to the length of smoking consumption period than in a group of smokers according to a number of cigarettes smoked daily (20.34 y *vs.* 13.55 y.). Hypertension (72% *vs.* 30.9%), angina pectoris (44.6% *vs.* 20.4%), CHD (30.6% *vs.* 22.8%) and myocardial infarction (16% *vs.* 11.4%) appeared much more in the group of smokers according to a number of cigarettes smoked daily. More reflection to the status of lipids and illnesses of cardiovascular system has the bigger number of smoked cigarettes daily than the length of the period of cigarette smoking.

KEY WORDS: smoking, cardiovascular diseases, cholesterol, low density lipoprotein cholesterol, high density lipoprotein cholesterol, triglycerides

Introduction

Link between smoking and disturbance of lipid degradation has been found. It was also determined that smokers have higher levels of total cholesterol (TC), triglycerides (TG), atherogenic VLDL-C, low density lipoprotein cholesterol (LDL-C) with lower level of high density lipoprotein cholesterol (HDL-C), which normally does not happen in non-smokers [1]. High level of triglyceride combined with high level of LDL-C leads to acceleration atherosclerosis and increases the risk for heart attack and stroke [2]. Cigarette smoking has been shown to raise the level of LDL-C by as much as 10% [3]. The initial trigger for the development of atherosclerosis is probably damage to the endothelial cells layer lining the artery. This damage may be caused by smoking, viruses, chemicals and drugs. In the earliest stages, yellow fatty streaks developed in the blood vessels are caused by the deposition of fats in the wall of the artery. They are yellow due to the deposited cholesterol. Fatty streaks will not cause any symptoms, but are the earliest sign of arterial disease and can progress to the development of atherosclerotic plaques. Plaques are caused by the accumulation of the LDL-C [4]. It is well known that increased level of serum cholesterol that is mainly consisted of LDL-C particles is the main risk factor for coronary disease and myocardial infarction, and it is also important risk factor for stroke. The importance of hypertriglyceridemia is that it is always followed by lower level of HDL-C which is a risk factor for development of atherosclerosis independently from the other factors [5]. The problem is whether the length of the period of cigarette smoking has a more reflection to the status of lipids and illnesses of cardiovascular system or the bigger number of smoked cigarettes daily in a shorter period?

* Corresponding author: Senaida Bišanović; Public Health Institution of Gradačac; Josip Šiber bb, 76 250 Gradačac; Bosnia and Herzegovina
Telephone number: +387 35 816 380; +387 61 159 504;
Fax number: +387 35 821 350; e-mail: bsenaida@bih.net.ba

Submitted 30 November 2010/ Accepted 25 January 2010

TABLE 1. Group by length of smoking consumption period. Structure of subgroups by gender and length of smoking consumption period

	0-5	5.1-10	10.1-15	15.1-20	20.1-25	25.1-30	>30.1	Total
Male	24	18	13	12	19	27	25	138
Female	6	12	17	18	11	3	5	72
Total	30	30	30	30	30	30	30	210

TABLE 2. Group according to the average number of cigarettes smoked daily. Structure of subgroups by gender and average number of cigarettes smoked daily

	10-20/24h	21-30/24h	31-40/24h	41-50/24h	>51/24h	Total
Male	8	12	21	26	26	93
Female	22	18	9	4	4	57
Total	30	30	30	30	30	150

Aim of the study: Are there any statistically significant differences in average values of the total serum cholesterol, serum triglycerides as well as LDL-C and HDL-C between the two groups of smokers? (Group of smokers according to the number of years they have been smoking and group of smokers according to the average number of cigarettes daily smoked). Are there any statistically significant differences in the frequency of illnesses of cardiovascular system between the two groups of smokers? Does the length of smoking have a greater impact on frequency of illness from cardiovascular diseases than the number of cigarettes smoked daily?

Materials and Methods

The sample has constituted of 360 smokers, both gender, age 25-64 years old. The sample was divided in two groups of smokers; the first group consisted of 210 examinees with different period of length of smoking cigarettes and the second group consisted of 150 examinees that smoked a different number of cigarettes per day. In the group of smokers according to the length of smoking period there were much more male smokers in older subgroups *vs*. much more female smokers in younger subgroups (Table 1). In the group of smokers according to average number of cigarettes smoked daily, there were much more "heavy smokers" in male subgroups *vs*. more "light smokers" in female subgroups (Table 2). The investigation was prospective, randomized, clinically and controlled study, from Tuzla region. Each examinee was treated per anamnesis, physical examination (blood pressure); ECG and laboratory tests of total cholesterol, triglycerides, HDL-C and LDL -C.

Inclusion criteria for the study:

- Age from 25 to 65 years, both gender,
- Smokers according to the length of smoking, from 0.1 to > 30.1 years,
- Smokers according to the number of cigarettes smoked daily.

Exclusion criteria for the study:

- other age groups (<25 and >65 years),
- Heart diseases dating from childhood (congenital heart defect),
- Diseases which can leave repercussion on hearth (endocarditis),
- Neurological diseases (sclerosis multiplex, Morbus Parkinson, amyotrophic lateral sclerosis, epilepsy),
- Diabetes mellitus,
- Examinees on the treatment with statins.

TABLE 3. Structure of groups of examinees by gender related to the length of smoking consumption period and the average number of cigarettes daily smoked

	Male	Female	Total
Smokers according to the length smoking consumption period	138 (65.7%)	72 (34.3%)	210 (100%)
Smokers according to the number of cigarettes smoked	93 (62%)	57 (38%)	150 (100%)
χ^2 test (α = 0.05)	0.37		NS

TABLE 4. Average values of smoking consumption period of examinees according to the length of smoking period and to a number of cigarettes smoked daily

	According to a number of cigarettes smoked daily	According to the length of smoking period
Average values	13.55	20.34
Std. Dev.	±8.206	±10.631
t-test	6.834	
p	0.0001	
Significance (α=0.05)	S	

Statistical analysis

The data were expressed as mean ± SD. The statistical significance between the groups by variables from goals of study was evaluated by hi-square test and Student's t test, using Statistical Package for the Social Sciences (SPSS Cary, NC, USA), version 14.

Results

There was no statistically significant difference between the genders of examinees (Table 3). Average value of smoking consumption period was higher in a group of examinees according to the length of smoking consumption period than in a group of examinees according to a number of cigarettes smoked daily. Certified with student t-test there was statistically significant difference between the groups (Table 4).

TABLE 5. Average values of serum cholesterol (mmol/L) in smokers according to the length of smoking period and according to a number of cigarettes smoked daily

	According to a number of cigarettes smoked daily	According to the length of smoking period
Average values	6.980	6.136
Std. Dev.	±0.8190	±1.0634
t-test	-8.499	
p	0.000	
Significance (α=0.05)	S	

TABLE 6. Average values of serum triglycerides (mmol/L) in smokers according to the length of smoking period and according to a number of cigarettes smoked daily.

	According to a number of cigarettes smoked daily	According to the length of smoking period
Average values	3.1586	3.1366
Std. Dev.	±1.7841	±1.5318
t-test	- 0.126	
p	0.900	
Significance (α=0.05)	NS	

TABLE 7. Average values of serum LDL-C (mmol/L) in smokers according to the length of smoking period and according to a number of cigarettes smoked daily

	According to a number of cigarettes smoked daily	According to the length of smoking period
Average values	3.8027	3.6424
Std. Dev.	±0.7181	±0.7083
t-test	- 2.104	
p	0.036	
Significance (α=0.05)	S	

TABLE 8. Average values of serum HDL-C (mmol/L) in smokers according to the length of smoking period and according to a number of cigarettes smoked daily

	According to a number of cigarettes smoked daily	According to the length of smoking period
Average values	1.0663	1.1606
Std. Dev.	±0.34993	±0.32249
t-test	1.746	
p	0.013	
Significance (α=0.05)	S	

The average values of cholesterol in both groups of examinees were very high, especially in a group of smokers according to a number of cigarettes smoked daily. Certified with t-test there was statistically significant difference between the groups (Table 5). The average values of triglycerides in both groups of examinees were higher, the differences between examined groups were minimal, and certified with student t-test there was no statistically significant difference between the groups (Table 6). It is evident that the average value of LDL-C in both groups of smokers are higher than the predicted values, thus the average value of LDL-C in a group of smokers according to a number of cigarettes smoked daily is higher than the average value of LDL-C in a group of smokers according to the length of smoking period. Certified with t-test there was statistically significant difference in average values of LDL-C between the groups (Table 7) In both groups of examinees the values of serum HDL-C were in predicted values, although the average value of serum HDL-C in the group of smokers according to a number of cigarettes smoked daily was lower compared to the average value of serum HDL-C of the group of smokers according to length of smoking period. Certified with t-test there was a statistically significant difference between the groups (Table 8). High blood pressure, angina pectoris, myocardial infarction and chronic heart disease appeared much more in the group of smokers according to a number of cigarettes smoked daily than in the group according to duration of smoking period. Chi square test showed that there was statistically significant difference between the groups (Table 9). As the most frequent ECG-changes in the both groups of ex-

TABLE 9. Existence of cardiovascular diseases in both groups of smokers

Smokers	Hypertension	Angina pectoris	Myocardial infarct	CHD	Without disease
According to duration of smoking period	65 (30.9%)	43 (20.4%)	24 (11.4%)	48 (22.8%)	115 (54.7%)
According to a number of cigarettes smoked daily	108 (72%)	67 (44.6%)	24 (16%)	46 (30.6%)	20 (1.3%)
χ^2 test (α= 0.05)	81.445	p<0.0001	S		

*CHD-chronic heart disease

TABLE 10. ECG changes at the smokers according to the length of smoking period and an average number of cigarettes smoked daily

	Ischemic coronary disease	Myocardial infarction	Heart rhythms disturbance	LVH	RVH	Left bundle branch block
According to the length of smoking period	41 (19.5%)	24 (11.5%)	19 (9.0%)	66 (31.4%)	11 (5.2%)	11 (5.2%)
According to a number of cigarettes smoked daily	101 (67.3%)	24 (15%)	33 (22%)	85 (56.6%)	12 (8%)	39 (26%)
χ^2 test (α= 0.05)	16.421	p=0.005	S			

*LVH - Left Ventricular Hypertrophy; *RVH - Right Ventricular Hypertrophy

TABLE 11. Existence of blood vessel diseases in smokers according to the length of smoking period and average number of cigarettes smoked daily

	According to the length of smoking period	According to a number of cigarettes smoked daily
ICV	17 (8.1%)	17 (11.3%)
PAD	7 (3.3%)	7 (4.6%)
PVD	31 (14.7%)	24 (16%)
χ^2 test (α= 0.05)	0.399	p>0.05 NS

*ICV-insult cerebrovascular; *PAD-peripheral arterial disease; *PVD-peripheral venous disease

aminees were registered ischemic coronary disease, left ventricular hypertrophy, heart rhythms disturbance and myocardial infarction. Certified with χ^2 test there was a statically significant difference between the examined groups (Table 10). Existence of blood vessels diseases (vascular diseases) was registered in both groups of examinees; where of the most frequent was peripheral venous disease, followed by stroke which appeared almost equally in both groups of examinees. Certified with χ^2-test there was no statistically significant difference between the groups (Table 11).

Discussion

Results of this investigation showed extremely high number of smokers among men in both groups; in the group according to the number of years of smoking consumption period male were represented with 65.7%, *vs.* 64% in the group according to a number of average numbers of cigarettes smoked on a daily basis. Female were found with 34.3%, in the group according to smoking duration *vs.* 38% in the group according to a number of average of cigarettes smoked daily. According to the results of National Health Interview Survey [6], 20.9% of US adults were current smokers. Current smoking was higher among men (23.4%) than women (18.5%). From 1993-2004, the percentage of daily smokers who smoked >25 cigarettes per day (cpd), (heavy smokers) decreased steadily from 19.1 - 12.1%. During the same period the percentage of daily smokers who smoked 1-4 cpd and 5-14 cpd increased, from 2.9 - 4.8% and from 20.6 - 28.4%, respectively. According to the 2008 National Survey on Drug Use and Health [7] among daily smokers aged 26 or older, 52.8% of them smoked a pack a day or more. A descriptive study [8] was conducted in a Government Hospital in the Sakarya city center in Turkey between June 2007 and June 2008 which aim was to investigate the relationship between the statuses of hospitalized children with diagnosis of respiratory tract diseases with cigarette use in the parents. In this study parental smoking was observed in 42.3% of fathers, and 7.8% of mothers and 20.9% both parents were smoking. It means, that at least one parent was a smoker in more than 71% of the families. Smoking rates at home were significantly higher in the family in which father educational status was low. Also, smoking rate of parents in the families who defined themselves in bad economic situation and the status of children exposed to cigarette smoke at home was determined high and differences were statistically significant. Indian Academy of Clinical Medicine presented a study [9] which had evaluated lipid profile in young smokers and compared it with non-smokers in the fasting state. There was significant increase in levels of total cholesterol, LDL-C, VLDL-C, and triglycerides in the men, while there was significant fall in average level of HDL-C in smokers as compared to that in non-smokers. It was revealed that mean serum triglycerides (181± 28.1 mg/dl), LDL-C (103.7±29.16 mg/dl) (p<0.05). Mean serum triglycerides levels in smokers were significantly high, (173±56.65 mg/dl) (p<0.01). Most of the smokers had been smoking for a mean duration of 8 years. An Indian study [10] included subjects who smoked at least fifteen cigarettes per day for 5-12 years. Aim was to determine the effect of cigarette smoking on changes in lipid profile, lipid peroxidation and antioxidant status in stable ischemic heart disease and acute myocardial infarction. Authors found that the levels of total cholesterol, triglycerides, LDL-C and VLDL-C were significantly increased (p<0.001), while the HDL-C level was significantly decreased in patients suffering from myocardial infarction and ischemic heart disease compared with control subjects. A highly significant increase (p<0.001) in serum cholesterol, triglycerides, LDL-C, VLDL-C and decrease in HDL-C level was noticed in smokers than in non-smokers in the myocardial infarction group. Chinese epidemiological survey [11] mainly reported considerable prevalence of hypertension (about 52%), obesity (near 48%) and dyslipidemia (over 50%), in individuals of over 30 years of age belonging to minorities from the pasture area of Xinjiang. No significant differences between men and women were detected (53.98% *vs.* 50.39%, χ^2=2.85, p=0.09). The prevalence of dyslipidemia was 50.79% in the whole study population. In our study we also analyzed the mean values of total serum cholesterol and triglycerides only in smokers. The mean value of cholesterol in the group according to a number of smoked cigarettes was (6.98±0.81 mmol/L), and in the group according to the length of smoking consumption period (6.13±1.06 mmol/L), so that we found a statistically significant difference between examination groups (p<0.05). Middle values of triglycerides were higher in both groups of examinees, but there was no any statistical signification. Also, middle values of LDL-C were higher in both groups of examinees, and we found statistically significant difference between examination groups (3.80±0.71 mmol/L *vs.* 3.64±0.70 mmol/L) (p<0.05). Compared with the values

of the other studies those values were significantly higher. In this study we have not found expected decrease of HDL-C values. In both groups of examinees the middle values of serum HDL-C were in predicted values, although the average value of serum HDL-C in the group of smokers according to a number of cigarettes smoked daily was lower and statistically significant difference compared to the average value of serum HDL-C of the group of smokers according to the length of smoking period. In this study existence of cardiovascular diseases is more often registered in the group of smokers according to a number of smoked cigarettes daily than in the group of smokers according to the duration of smoking consumption period; hypertension (72% *vs.* 30.9%), angina pectoris (44.6% *vs.* 20.4%) twice more, chronic heart disease (30.6% *vs.* 22.8%) and myocardial infarction (16% *vs.* 11.4%). The first observational study of risk factors for coronary heart disease which followed in 7 countries, 25 years, confirmed that number of smoked cigarettes elevated the risk of several cardiovascular diseases [12]. Daily cigarette smoking increased the risk of fatal stroke three and half times in Chinese population [13]. The researchers studied a representative sample of 83.533 men and 86.336 women, 40 years and older, from 17 provinces in mainland China. After adjusting for other stroke-related factors such as age and blood pressure, cigarette smoking was found to be a significant predictor of stroke. Cigarette smoking accounted for 14.2% of strokes and 7.1% of stroke deaths in men *vs.* 3.1% of strokes and 2.4% of stroke deaths in women. Compared with never smokers, the risk of stroke increased 21% for those smoking 1-19 cigarettes per day and 36% for those smoking 20 and more cigarettes per day. We also certified the average value of smoking consumption period, which was higher in a group of examinees according to the length of smoking consumption period than in a group of examinees according to a number of cigarettes smoked daily, and we found statistic signification between the groups (20.34 *vs.* 13.55 yrs). In a descriptive hospital based one year study [14], in Karachi on ninety patients with stroke, 74.4% had cerebral infarction and 25.6% had cerebral hemorrhage. Hypertension was the most common modifiable risk factor in 60%, followed by smoking in 44.4%, diabetes in 25.5%, dyslipidemia in 18.8%, heart disease in 7.7% and alcoholism 3.3% of cases. In this investigation there were 360 smokers enrolled, with the age of 20-65 years, both gender, and we found that 8.1% of examinees in the group according to the length of smoking consumption period *vs.* 11.3% of examinees in the group according to a number of smoked cigarettes had stroke. In the group according to a number of smoked cigarettes the most cases of stroke were registered in the subgroups of smokers who smoked more than 41 cigarettes per day. Also, we found in the group by length of smoking duration period that the most cases of stroke were registered in the subgroup of smokers who smoked for 25.1-30 years.

Conclusion

There were higher average values of total cholesterol (6.98 *vs.* 6.13 mmol/L), triglycerides (3.15 *vs.* 3.13 mmol/L) and LDL-C (3.80 *vs.* 3.64 mmol/L) in a group of smokers according to a number of smoked cigarettes daily. The average value of HDL-C was of predicted value, although lower value of HDL-C was registered in a group of smokers according to a number of smoked cigarettes. Highly statistically significant difference was estimated in the values of total cholesterol, LDL-C and in HDL-C in the group of smokers according to a number of cigarettes smoked daily, than in the group of smokers according to the length of smoking period. The number of smokers who suffer from high blood pressure, angina pectoris, myocardial infarction and chronic heart disease is more often registered in the group of smokers according to a number of smoked cigarettes compared to a group of smokers according to the duration of smoking consumption. We were confirmed the hypothesis that a bigger number of smoked cigarettes per day has more reflection to the status of lipids, and a bigger impact on frequency of illness from cardiovascular diseases than the length of smoking years.

Declaration of interest

None to declare.

References

[1] Čop N. Smoking and stroke. Medicus 2001; 10:57-58.
[2] World Heart Federation [Internet]. Geneva:World Heart Federation; 2004 [cited 2010 December 10]. Available from http://www.world-heart-federation.org/...health/.../cholesterol/
[3] Salander M.J. Cigarettes and hypertension; a deadly duo-Hypertension [Internet]. New York: Review and Herald Publishing Association; 1996 [updated 2004; cited 2010 November 29]. Available from http://www.findarticles.com/p/articles/mi.../ai_18001432/
[4] Hansson GK.Inflammation, atherosclerosis, and coronary arthery disease. New Engl J Med 2005; 352:1685
[5] Reiner Ž. Sušić M. The disorder of metabolism of lipids. In; Vrhovec B, Francetić I, Jakšić B, Labar B, Vučelić B. The Internal medicine, 3rd ed. Zagreb: National and University Library Zagreb;1991, pp.1316-1317.
[6] From the Centers for Disease Control and Prevention Morbidity and Mortality Weekly Report. Cigarette Smoking Among Adults-United States, 2004. JAMA 2006; 295(7):749-751.
[7] Baker E. How many cigarettes does the average smokers smoke?[Internet].[Place unknown]: Answerbag Staff; 2010 [updated 2010 April 13; cited October 25]. Available from http://www.answerbag.com/q_view/2010729/

[8] Cinar N, Dede C, Cevahir R, Sevimil D. Smoking status in parents of children hospitalized with diagnosis of respiratory system disorders. Bosn J Basic Med Sci 2010; 10(4): 319-322.
[9] Neki NS. Lipid Profile in Chronic Smokers. A Clinical Study. JIACM 2002, 3:51-54.
[10] Pasupathi P, Rao YY, Farook J, Saravanan G, Bakthavathsalam G. Effect of Smoking on Lipids and Oxidative Stress Biomarkers in Patients with Acute Myocardial Infarction. Res J Med Med Sci 2009;4: 151-9.
[11] Xiao-Guang Y, Frommlet F, Zhou L, Zu F, Hong-Mei W, Zhi-Tao Y. et al.. The prevalence of hypertension, obesity and dyslipidemia in individuals of over 30 years of age belonging to minorities from the pasture area of Xinjiang. BMC Public Health 2010; 10:91.
[12] Jacobs R.D, Adachi H, Mulder I, Kromhout D, Menotti A, Nissinen A. et al. Cigarette Smoking and Mortality Risk. Arch Intern Med. 1999;159:733-740.
[13] Kelly N. T, Gu D, Chen J, Huang J, Chen Ji-chun, Duan X et al. Smoking Is Major Risk Factor for Stroke in China. AHA. 2008; 214: 706-1135.
[14] Syed Riazul H, Ahmad S, Khan G. Frequency of known risk factors of stroke and its outcome in patient admitted in Sindh Government Qatar Hospital Karachi. Pak J Med Sci 2007; 23(4):634-636.