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Effects of smoking on healthy young men's hematologic parameters

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ABSTRACT

OBJECTIVE: Cigarette smoking carries higher risks for most of the chronic diseases. It also has chronic and acute effects on the hematologic system. This study explores the effects of cigarette smoking on some blood values of the healthy young male smokers.

METHODS: In this study, cigarette smoking and usage of substance, additional diseases, birth places, and education levels of 171 healthy male subjects between the ages of 20 and 30 years were investigated. Anthropometric measurements of the cases were obtained. Thyroid function tests, vitamin B12, folic acid, ferritin, ferrous/ıron, total ıron binding capacity, leucocytes, platelets, hemoglobin, hematocrit, mean corpuscular volume (MCV), mean platelet volume (MPV), HBs AG, Anti-HBs and Anti-HIV were evaluated. Groups of smokers and nonsmokers were compared. The group of smokers was also sorted into subgroups of "2 year-smokers", "5 year-smokers" and "10 year-smokers" according to their pack-years of smoking. The effects of pack-years of smoking on the blood values were also investigated.

RESULTS: The MCV values of the group of smokers were higher than the values of nonsmokers, which were statistically significant ($p<0.05$). As a result of the subgroup analyses of smokers, the white blood cell (WBC) counts of the individuals smoking for 5 or more years were significantly higher than those with a history of smoking less than 5 years, ($p<0.05$).

CONCLUSION: This study supports the idea that cigarette smoking and especially longer durations of smoking have adverse effects on the hematologic parameters.

Key words: Cigarette, hematologic parameters, young man

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Smoking is the most important public health problem. Many studies performed have proved its deleterious effects on many organ systems mainly respiratory,and cardiovascular systems. With 6000 chemical substance it contains, it exerts pharmacological, mutagenic, cancerogenic, toxic, and inflammatory effects [1]. Nowadays, it is responsible for every six cases of death [2]. Cigarette contains carcinogens (polycyclic aromatic hydrocarbons etc.), irritant substances, nicotine, carbon monoxide, and other gases. Cigarette smoke contains many oxidants, and free radicals which can harm lipids, proteins, DNA, carbohydrates, and other biomolecules [3]. The effects of smoking on various metabolic, and biological processes, hormone secretion, and hematopoietic system have been demonstrated. In many studies, among acute effects of smoking on hematological system, increases in WBC, eosinophil, and platelet (PLT) counts have been shown [1]. A correlation was established between smoking, and WBC counts. Relatively higher WBC counts were detected in smokers [4, 5, 6, 7, 8, 9, 10]. Smoking has been suggested to increase the levels of hematological parameters as hemoglobin (Hb) concentration, red blood cell (RBC), neutrophil, eosinophil, monocyte, and platelet counts. Smoking cessation studies have demonstrated that some of these changes are reversible, and transitory in case of cessation of smoking [11]. In our study, we investigated the effects of smoking, and especially duration of smoking in healthy young men on anthropometric measurements, thyroid function tests, vitamin B12, folic acid, ferritin, serum iron, total iron binding capacity (TIBC), whole blood counts, HBsAg, anti-HBs, anti-HCV, and anti-HIV values.

MATERIALS AND METHODS

Our cross-sectional study was performed on healthy 171 male patients aged 20-30 years who consulted to Pınarhisar State Hospital between October 2012, and February 2013 for any indication. The first group consisted of smokers, and the second group of life-time nonsmokers. The cases who had acute infections, chronic diseases, acute bleeding episodes, cancer patients, and corticosteroid drug users were not included in the study. From available recordings, patient's age, measurements of body weight (kg), height (cm), waist circumference (cm), and blood pressures were retrieved. Measurements of body weight, and height were made while barefooted patients were wearing light clothes. Body mass index (BMI) was calculated by dividing body weight (kg) by square meter of the height. Waist circumference was measured from the midpoint between the costal arch, and spina iliaca anterior superior. Arterial blood pressure (ABP) was measured using mercury sphygomanometer. The cuff of the sphygomanometer was wrapped around the arm with its lower end 2.5-3 cm away from the cubital fossa. Cuff was placed on the brachial artery. Information about educational level, smoking status, substance use, and existing disease was recorded after verbal approval of the patient.

Thyroid function tests (thyroid stimulating hormone: TSH, free T4: fT4, free T3: fT3), vitamin B12, ferritin, and folic acid were analyzed with electrochemiluminescence method using Roche cobas e 601 device. Normal ranges of some analytes set for this device were: TSH, 0.27-4.20 uIU/mL; fT4, 12-22 pmol/L; fT3, 3.1-6.8) pmol/L, vitamin B1, 156-698 pmol/L; ferritin 30-400 ng/mL, and folic acid, 4.6-34.8 ng/mL.

Hepatitis B surface antigen (HBsAg), antibodies both to the surface antigen (anti-HBs), HCV (anti-HCV), Anti -HIV tests were analyzed in Roche cobas e 411 device using an electrochemiluminescence method. Normal ranges of some analytes set for this device were: HbsAg, 0-1 S/CO, Anti Hbs negativity, 0-9.999 IU/L, Anti Hbs positivity, ≥10 IU/L; Anti HCV 0-1 S/CO; Anti –HIV, 0-1 S/CO.

Iron, and iron binding capacity were tested in Roche cobas c 501 device using a colorimetric method. Normal ranges for iron, and iron binding capacity were accepted as 33-193 ug/dl, and 250-450 ug/dl, respectively.

Hemoglobin, hematocrit, white blood cell, and platelet counts, mean erythrocyte, and platelet volumes were assessed in ABX Pentra DF device using electronic cell counter method. Normal ranges of some analytes accepted for this device were: he-

moglobin 11-16.5 g/dL, hematocrit 34-48%, WBC 3.8-9.8 103/uL; platelets, 180-350 103/uL; MCV, 80-100 fL, and MPV 7.6-10.8 fL.

Statistical analysis

For descriptive analysis of data mean, standard deviation, ratio, and frequencies were used. Distribution of variables was controlled with Kolmogorov-Smirnov test. In the analysis of quantitative data Mann-Whitney-U test, and independent sampling test, and for qualitative data chi-square test, and if not suitable Fisher's exact test were used. In statistical analyses, SPSS 21.0 program was used.

RESULTS

A total of 171 healthy male individuals aged 20-30 years were included in the study, and divided into smoker (n=101), and nonsmoker (n=70) groups.

Between smoker, and nonsmoker youngsters, a significant difference was not found as for age, body weight, waist circumference, ABP, and co-

TABLE 1. Anthropometric measurements, educational level, blood pressure values, substance use, hepatitis markers, and presence of comorbities groups of smokers, and nonsmokers

	Smokers			Nonsmokers			p
	n	%	Mean±SD	n	%	Mean±SD	
Age (years)			21.96±2.34			21.55±2.20	0.182
BMI (kg/m^2)			23.91±3.35			22.67±3.57	0.022
Waist circumference (cm)			85.44±7.81			84.43±7.99	0.412
Educational level							
None	1	1.4		3	3.0		0.033
Primary	13	18.3		11	11.0		
Secondary	20	28.2		51	51.0		
Lycée	18	25.3		22	22.0		
University	19	26.8		13	13.0		
Hypertension (ABP) mmHg							
Yes	68	95.8		95	95.0		0.813
No	3	4.2		5	5.0		
Substance use							
Yes	70	98.6		89	89.0		0.016
No	1	1.4		11	11.0		
Comorbidity							
Yes	67	94.4		91	91.0		0.413
No	4	5.6		9	9.0		
HBsAg (S/CO)							
None	71	100		96	96.0		0.088
Present	0	0		4	4.0		
AntiHBs (S/CO)							
None	43	60.6		51	51.0		0.215
Present	28	39.4		49	49.0		

BMI: Body Mass İndex; Chi-square test/Independent samples t-test/Mann-Whitney U test.

morbidities (p>0.05), (Table 1). BMIs, and educational level (lycée or university) were significantly lower in smokers when compared with nonsmokers (p<0.05). Still substance use among smokers, was significantly higher when compared with nonsmokers. (p<0.05), (Table 1). Smoking had not any significant effect on HBsAg, antiHBs, TSH, fT4, fT3, vitamin B12, folic acid, PLT, Hb, Htc, MPV, ferritin, iron, and TIBC values, however MCV values of young smokers were observedly higher than those of the nonsmokers (p<0.05), (Table 2).

When group of smokers was classified based on duration of smoking of <2 (Group 1), and ≥2 (Group 2) years, age, height, body weight, waist circumference, BMI, educational level, substance use, ABP values, incidence of comorbidities, HBsAg, antiHBs, TSH, fT4, fT3, vitB12, folic acid, WBC, PLT, Hb, Htc, MCV, MPV, ferritin, iron, TBIC values did not differ between groups (p>0.05).

Age, height, body weight, waist circumference, BMI, educational level, substance use, ABP values, incidence of comorbidities, HBsAg, antiHBs, TSH, fT4, fT3, vitB12, folic acid, WBC, PLT, Hb, Htc, MCV, MPV, ferritin,iron, TBIC values did not differ according to the years of smoking for less or more than 5 years, respectively (p>0.05). While WBC values were found to be significantly higher in young male individuals with a smoking history of ≥5 years (p<0.05), (Table 3).

Any significant difference was not detected as for height, body weight, waist circumference, educational level, substance use, comorbidities, and ABP values between groups of individuals with a smoking history of <10, and >10 years, respectively (p>0.05). While WBC values were found to be significantly higher in young male individuals with a smoking history of more than 10 years (p<0.05).

DISCUSSION

Smoking is known as a high risk factor for cardiovascular diseases, hypertension, inflammation, stroke, coagulopathies, and respiratory diseases [4, 5, 6, 7, 8, 9, 10]. Besides, as shown in various studies, smoking accelerates cancerogenesis in various organs as lungs, pancreas, kidney, and liver [5, 6,

Table 2. Whole blood cell counts, and hormonal values of the groups

	Nonsmokers	Smokers	p	
	Mean±SD	Mean±SD		
TSH (uIU/mL)	1.86±0.81	1.74±0.83	0.340	
Ft4 (pmol/L)	15.46±1.97	15.55±1.70	0.740	
Ft3 (pmol/L)	5.77±0.67	5.77±0.66	0.971	
VitB12 (pmol/L)	206.80±81.57	216.09±81.25	0.463	
Folic acid (ng/mL)	6.93±1.69	6.65±1.83	0.298	
WBC (uL)	7.23±1.94	7.36±1.85	0.675	
PLT (uL)	250.41±59.12	246.62±70.17	0.323	m
Hb (g/dL)	14.98±1.09	15.11±1.42	0.520	
Htc (%)	44.97±3.63	44.76±5.45	0.874	m
MCV (fL)	84.34±3.68	85.59±3.94	0.035	
MPV (fL)	7.58±0.89	7.66±1.28	0.671	
Ferritin (ng/mL)	88.72±67.41	82.06±65.64	0.498	m
Iron (ug/dl)	86.56±34.02	89.20±35.21	0.623	
TIBC (ug/dl)	334.61±54.76	330.91±57.19	0.670	

Independent samples t-test / Mann-Whitney U test.

Table 3. Correlations between cigarette smoking for less or more than 5 years, and some hematological parameters

	Smoking history ≤5 years	Smoking history <5 years	p	
	Mean±SD	Mean±SD		
TSH (uIU/mL)	1.65±0.87	1.85±0.77	0.230	
Ft4 (pmol/L)	15.77±1.84	15.28±1.49	0.158	
Ft3 (pmol/L)	5.71±0.67	5.83±0.64	0.374	
vitB12 (pmol/L)	207.55±81.30	226.96±80.79	0.238	
Folic acid (ng/mL)	6.35±1.49	7.03±2.14	0.063	
WBC (uL)	6.98±1.55	7.83±2.10	0.022	
PLT (uL)	249.38±75.08	243.11±64.05	0.779	m
Hb (g/dL)	15.18±1.42	15.01±1.43	0.564	
Htc (%)	45.19±3.57	44.21±7.18	0.236	m
MCV (fL)	85.61±4.21	85.57±3.61	0.961	
MPV (fL)	7.61±0.81	7.72±1.70	0.674	
Ferritin (ng/mL)	78.14±76.69	87.05±48.51	0.085	m
Iron (ug/dl)	85.79±40.33	93.55±27.19	0.276	
TBIC (ug/dl)	332.14±53.82	329.34±61.81	0.809	

Independent samples t-test/Mann-Whitney-U test.

12]. Effects of smoking on hemapoietic system have been also analyzed in many studies. In our study, we also investigated the impact of smoking on hematological parameters.

The mechanism of action of smoking on WBC is not clear-cut yet. In smokers, lymphocytosis is thought to be mainly associated with an increase in T-cells [13]. Nicotine which is a component of cigarette smoke, stimulates cathecolamine release, and induces increase in cortisol levels. Increases in peripheral blood WBC counts, and alterations in WBC function can be the result of direct damage stemming from alterations in epithelial, and endothelial surfaces and/or cytokine levels (especially IL-6) caused by components of cigarette smoke [14]. In a study on the impact of smoking on hematological parameters, WBC, red blood cells, Hb, and Htc levels were found to be markedly increased, while MCV, and platelet counts were lower. These changes have been associated with atherosclerosis, polycythemia vera, chronic obstructive pulmonary disease, and cardiovascular diseases, and also higher risk of atherosclerosis, polycythemia, chronic obstructive pulmonary disease, and cardiovascular disease in smokers has been revealed [15]. Kurtoğlu et al. detected that smoking significantly increased WBC, neutrophil, lymphocyte, monocyte, platelet counts, Hb, Hct, and RBC indexes in both genders [16]. Also some studies comparing smoker, and nonsmoker groups have demonstrated increases in Hb, Hct, RBC, MCV, WBC, neutrophil, lymphocyte, eosinophil, and monocyte counts in both groups [17, 18, 19, 20, 21, 22]. Similarly when smokers, and nonsmokers were compared, rates of MCV were found to be significantly higher in smokers in compliance with the literature. Zafar et al. investigated the impact of smoking on RBC, WBC, and Hb, and indicated increases in WBC counts, and decreases in RBC, and WBC counts in smokers. Linear regression model demonstrated a positive correlation between number of pack-years, and total WBC count, and the authors stressed the importance of these increments. Presence of a positive correlation has been revealed between pack-years of smoking, and WBC counts. Studies displayed sustained, and important increments in

WBC counts in line with pack-years of smoking. Even smoking 10 cigarettes a day led to important increase in WBC counts [23].

In our study, when we analyzed the impact of years of smoking on WBC counts, we detected significant increases in WBC counts in individuals with a smoking history of 5 or more years. However in individuals who used tobacco products for less than 5 years, we couldn't detect any effect of smoking on WBC counts. Our study population consisted of healthy young adults without any chronic disease. We think that effects of smoking in individuals without any history of chronic disease can be seen at an earlier phase.

The harmful effects of smoking on hematological parametres improve with a little bit decrease in the daily number of cigarettes smoked. If chronic smokers quit smoking, then, as has been demonstrated in many studies, most of the parameters related to red, and white blood cells rapidly return to their normal values [24].

Even though place of smoking in social life has changed in recent years, it is prevalent among people of lower socioeconomic status as had been previously. Smoking age has decreased down to pediatric age owing to social pressure, and popular culture [25]. Our study population consisted of youngsters aged 20-30 years. Our cases with a median age of 21, comprised most of our study population who had been using tobacco products for 5 years. Some of our patients started to use cigarettes while they were just a small child, and continued to use them for 15 years. Substance use was more frequent among smokers. Educational level of smokers (lycée, and high school) was significantly lower relative to non-smokers which reveals the importance of education. Awareness should be raised in the community about smoking, and its harmful effects. With decrease in the prevalence of smoking, the incidence of chronic diseases whose treatment incur a great financial burden on public expenditures will drop significantly.

In conclusion, in our study, unfavourable effects of smoking on hematological parameters have been demonstrated, and correlation between pack-years, and these harmful effects have been determined. Physicians who have an important role in the protection of public health, should inquire from their patients about their smoking history at every visit, and recommend cessation of smoking. Even though public awareness about harmful effects of smoking has been raised considerably, still every effort should be made on this issue.

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