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Original Research Paper

Physiology

EFFECT OF CIGARETTE SMOKING ON HEMATOLOGICAL FACTORS

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ABSTRACT

Background: This study examines the effect of cigarette smoking on various hematological parameters which comprised of complete blood count. **Material And Method:** In this study we have taken 60 males either students or the staffs of Government Medical College Banda. Out of 50 volunteers, 30 smokers and 30 nonsmokers were taken with an age range of 20-50 years old. **Result:** Our results reveals that there is a significant rise found in the white blood cell, red blood cell, hemoglobin and hematocrit count among smokers group compared with nonsmokers group ($p<0.05$). The mean corpuscular volume was also found significantly increased ($p<0.05$) in smokers compared with control group but there were no significant changes found in mean corpuscular hemoglobin and platelet count ($p>0.05$). Our results also shown that the lymphocytes and eosinophils were significantly higher ($p<0.05$) in smokers compared with the nonsmokers. Apart from this our study reveals that there were no significant changes found in neutrophil, monocyte and basophil in all groups ($p>0.05$). **Conclusion:** Our study indicates that the cigarette smoking significantly affects the WBC, RBC, Hb, Hct, MCV, Lymphocytes and Eosinophills, but did not affect platelets, netrophills, monocites and basophils.

KEYWORDS : cigarette smoking, complete blood count, RBC, WBC, blood indices

INTRODUCTION:

Although tobacco has dangerous effect on human health, it still highly consumed throughout the world. Smoking is one of the most common addictions of modern times. Its etiological agent for various chronic diseases, including a variety of infections, cancers, heart diseases and respiratory illnesses [1]. Cigarette smoke (CS) contains over 4000 compounds, including at least 200 toxicant, 80 known or suspected carcinogens. Moreover, cigarette smoking generates many toxic and carcinogenic compounds harmful to the health, such as nicotine, nitrogen oxides, carbon monoxide, hydrogen cyanide and free radicals [2]. Nicotine is commonly consumed via smoking cigarettes, cigars or pipes [3]. Carbon monoxide in tobacco smoker exerts a negative effect on the heart by reducing the blood's ability to carry oxygen. Although cigarette smoking is a strong risk factor for cardiovascular disease, its relationship with hypertension remains unclear [4].

Cigarette smoking contributes to the development of many chronic diseases associated with age [5]. One major risk factor for morbidity and mortality among adults was smoking cigarette. Smoking responsible for 90% of lung cancer cases among males, the major risk factors that cannot be changed which associated with heart disease was age, smokers who are still relatively young can reverse some lung damage by quitting smoking, but in middle-aged and older smokers some damage seems to be irreversible [6]. The main way for the arrival of cigarette smoke into the smoker's blood by gaseous exchange that occurs in the lungs, so the lungs damaged larger than the rest of the members of the body.

MATERIALS AND METHODS:

The sample was selected at random (60) from male volunteers from the students and the staff at Government Medical College Banda, after obtaining the ethical clearance and signed consent: (30) smoker and (30) non-smokers were stratified by age into three groups of 20-29, 30-39, 40-49 years equal number in each group (10). The samples of this study were normotensive and free of other cardiovascular risk factors and were not taking any medications. Each individual included in this study was asked about cigarette smoking habit, number of cigarettes consumed per day, and duration of smoking. Blood pressure (systolic and diastolic) was measured from the brachial artery, using a standard mercury sphygmomanometer in the right arm in a sitting position, after a steady state at 3-5 minutes. 3ml of blood was collected from the vein and injected in EDTA test tube gentle mixing was done immediately to ensure complete anticoagulation of the blood. Serum was obtained by Centrifugation 1 ml of blood in EDTA test tube for hematological tests (WBC, RBC, Hb, Hct, plt, Mcv, Mch , Mchc, lumph, mono, Baso, Eso) by using Sysmax device.

Statistical Analysis:

The researcher used the statistical program (SPSS) in data processing and extract results, the statistical methods used (ANOVA test, arithmetic mean test, and standard deviation).

RESULTS:

Table 1, shows a significant increase ($p<0.05$) in WBC, RBC count, hematocrit valve and MCV in smokers compared with non- smoker of the same age group. The MCHC was significantly decreased ($p<0.05$) in smoker of age groups 30-40 compared with non- smoker of the same age group. A non-significant change was observed in MCH valves and platelet count in all age groups. Table 2 shows a significant increase ($p<0.05$) in Lymphocyte, eosinophil count in smokers compared with non- smoker of the same age group. A non-significant change was observed in Neutrophil, Monocyte and basophil counts in all age groups.

DISCUSSION:

The current study showed significant differences in hematological parameters of smokers and non-smokers where the WBC, RBC, Hb, HCT and MCV were significantly high, whereas MCHC was significantly low in smokers as compared to non-smokers. We did not find any significant difference in, MCH, and PLT level We found that the smokers had significantly higher in WBC count ($p<0.05$) compared to non- smokers this result agree with that of [7,6,8] . The relation of high WBC count with smoking could be due to the presence of a subclinical inflammatory reaction [9]. The leukocytosis may simply be a marker of smoking-induced tissue damage, this high count can promote cardiovascular diseases through multiple pathologic mechanisms that mediate inflammation, plug the microvasculature, induce hypercoagulability and promote infarct expansion [10]. Some researchers found that the blood leukocyte count was increased by as much as 30% in smokers, because the biologic mechanisms for a persistent effect of smoking on white blood cell count [11]. The current study showed the smokers had significant increase in RBC count ($p<0.05$) compared to non-smokers this rustle agree with [12] and Contrary to [13]. The increase in RBC count is termed as polycythemia and a very high of RBC mass slows blood velocity and increases the risk of intravascular clotting, coronary vascular resistance decreased coronary blood flow, and a predisposition to thrombosis [14]. The mechanism by

which polycythemia causes thrombosis is still under investigation, but smoking cigarettes creates a unique condition of combined polycythemia to chronic hypoxia, leading to elevated red cell production because of an elevated carboxyhemoglobin level with concomitant plasma volume reduction. [15]. Some possible mechanisms are reported by which cigarette smoking could cause such changes in the red blood cells. Carbon monoxide, one of the chemicals identified in tobacco smoke, may induce hypoxia, usually the body responds to hypoxia by increasing the number of erythrocytes [16]. Excessive tobacco can be result in polycythemia because this situation created a real oxy-carbon poisoning, so there was an extra oxygen demand and production of red blood cells increases to cope [17]. We found that the smokers had significantly higher hemoglobin concentrations ($p<0.05$) compared to non-smokers this rustle agreement with [18]. Elevated levels of hemoglobin are correlated with increased numbers or sizes of RBCs. and are consistent with other studies [19,20]. Both high and low hacmoglohin levels increase mortality and morbidity, smoking cessation lowered mean hemoglobin 1.6 g/dl compared with nonsmokers [6]. Hemoglobin concentrations were significantly associated with increasing age in cigarette smoking men . The study were demonstrated other studies support by [21,22]. Who found that increasing age was significantly associated with higher hemoglobin concentrations and smoking was significantly associated with higher hemoglobin, smoking cessation becomes more difficult when habit was developed early in life because of the nicotine tolerance that is built up through years of smoking, [6]. Hematocrit values were also significantly higher in smokers than those of non-smokers ($p<0.05$) and consistent with previous studies [23]. Higher levels of hematocrit may cause polycythemia vera (PV), a myeloproliferative disorder in which the RBCs are produced excessively by bone marrow and also related to an increased risk of development of atherosclerosis and cardiovascular disease [18]. An increased hematocrit may reduce the coronary blood flow and increase adhesion of platelets to the aortic subendothelium, which may contribute to the early formation of atherosclerosis and thromboembolic disease [16]. MCV, MCH and MCHC are three main red blood cell indices that help to measure the average size and hemoglobin composition of the red blood cells . We found an increase in MCV and decrease in MCHC levels in smokers than those of non-smokers ($p<0.05$) and this result is consistent with previous studies [18]. MCV indicates the size of a red blood cell and presence of red cells smaller or larger than normal size means the person has anemia, elevated levels of MCV indicates that subjects might suffer from megaloblastic , hemolytic, pernicious or macrocytic anemia usually caused by iron and folic acid deficiencies [18].

The increase in hemoglobin, hematocrit, MCV could be due to the inhaled carbon monoxide gas (CO), which is one of the inhaled components of cigarette smoke. CO present in cigarette smoke in more than 600 times the concentration considered safe in industrial plants. A smoker's blood typically contains 4 to 15 times as much CO as that of a nonsmoker. CO combines reversibly with oxygen-carrying sites on the hemoglobin molecule by about ranging from 210 to 240 times greater than that of oxygen, which results in decreased oxygen-carrying capacity of the blood, this decrease is compensated by an increase in hemoglobin and hematocrit [24]. MCH is the average weight of hemoglobin that is present inside a single red blood cell whereas MCHC denotes the amount of hemoglobin in a specific volume of 'packed' red cell. We found significantly low value of MCHC ($p<0.05$) in smokers indicating hypochromic anemia and might be due to paucity of folic acid or vitamin B12 or thyroid problems [18]. This study showed that Lymphocytes and eosinophils were significantly higher in the smokers than in smoker group ($p<0.05$) This result was in agreement with [25]. Who reported that Lymphocytes strongly associated with number of cigarettes per day and packer per years, may be due to the glycoprotein from tobacco leaf may stimulate lymphocyte spread and differentiation [26]. And may be due to residual chronic inflammation of respiratory tract [25] .

The lymphocytosis can be attributed to chronic tissue damage and inflammation produced by toxic smoke products. This result was in agreement with [27]. Also [13], reported that leukocytosis in smokers is mainly attributable to an increased lymphocyte count. The increase in eosinophils in smoker groups is correlated with a study published in British Journal of Hematology The possible cause of increase in Eosinophil count may be due to smoking allergy in respiratory tract [28] .Or may be due to cannabis plants are contaminated with a number of fungal spore organisms, which cause secondary eosinophilic pneumonia [27]. They exhibit specialized function in certain disorders and are conspicuously active in their protection against foreign substances like smoke and cannabinoids [26]. The study demonstrated no significant differences in neutrophil, monocytes and basophil count. This result was in agreement with [13,25]. This study showed a significant increase in blood pressure in the smokers than in control (non-smoker) group ($p<0.05$) This result was in agreement with [29,12].

Conflict Of Interest:
None.

Table 1: The Effect Of Smoking On Hematological Parameters Of Smoker And Nonsmoker Groups (value Are Mean ±Sd).

No.	hematological parameters	age/yrs	smokers	Non-smokers	L.S.D ($p<0.05$)
1	WBC (Cells/mm3)	20-29	8.631[c] ±1.90	6.550 ±1.706	1.972
		30-39	8.786[b] ±2.363	7.201 ±1.862	
		40-49	10.061[a] ±2.356	7.618 ±1.537	
2	RBC(Million) Cells/mm3)	20-29	5.175 ±0.226	5.619 ±0.277	1.009
		30-39	6.491b ±1.639	5.278 ±0.263	
		40-49	7.459[a] ±1.325	5.111 ±0.297	
3	Hb (g/dl)	20-29	15.350 ± 0.607	15.530 ±0.653	2.342
		30-39	17.530[b] ±3.997	14.620 ±0.687	
		40-49	20.913[a] ± 3.533	15.248 ±1.848	
4	HCT%	20-29	47.04 ±1.093	47.570 ±1.911	6.402
		30-39	52.960b ±10.950	45.000 ±2.168	
		40-49	59.847a ±8.333	45.319 ±6.988	
5	MCV (fl)	20-29	91.040[c] ±3.807	84.770 ±4.067	5.099
		30-39	114.640[a] ±8.116	84.140 ±3.104	
		40-49	101.542[b] ±3.788	87.290 ±6.018	
6	MCH (pg)	20-29	25.900 ±0.917	27.690 ±1.401	N.S
		30-39	27.260 ±2.456	26.910 ±2.100	
		40-49	27.830 ±3.356	29.380 ±2.023	

7.	MCHC (g/dl)	20-29	31.988 ±0.676	32.670 ±0.940	1.561
		30-39	29.214[b] ±1.136	32.380 ±1.270	
		40-49	29.048[a] ±2.819	33.513 ±1.592	
8.	PLT 103/mL	20-29	248.813 ±43.590	250. 772 ±25.869	N.S
		30-39	260.500 ±54.324	268.115 ±86.724	
		40-49	245.251 ±66.050	255.651 ±49.330	

* (a,b signify p<0.05).

Table 2: The Effect Of Smoking On Differential Leucocyte Count In Smoker And Non- Smokers Groups. (Value Are Mean ±sd).

NO.	Differential Leucocyte %	age/ yrs	smoker	Non-smoker	L.S.D
1.	NEUT %	20-29	56.540 ±12.237	54.250 ±13.295	N.S
		30-39	55.590 ±9.926	55.440 ±8.421	
		40-49	46.387 ±6.347	58.475a ±3.039	
2.	LYMPH %	20-29	43.710b ±9.188	34.610 ±11.769	9.368
		30-39	42.880c ±10.180	35.860 ±7.443	
		40-49	43.787a ±7.702	33.275 ±5.606	
3.	MONO %	20-29	6.810 ±2.717	7.950 ±2.199	N.S
		30-39	6.940 ±2.188	6.400 ±2.957	
		40-49	6.251 ±2.914	7.502 ±1.954	
4.	Eosi %	20-29	1.990 ±1.074	1.900 ±1.360	1.224
		30-39	2.230 ±1.380	2.170 ±1.208	
		40-49	3.126[a] ±1.691	2.125 ±0.670	
5.	BASO %	20-29	0.500 ±0.377	0.380 ±0.239	N.S
		30-39	0.360 ±0.164	0.330 ±0.163	
		40-49	0.442 ±0.127	0.425 ±0.275	

*(a,b signifiy p<0.05)

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