

Effect of cigarette smoking on some hematological & biochemical factors in blood of men with aging

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Abstract

This study investigated the relationship between cigarette smoking and hemoglobin concentrations, red blood cell counts, white blood cell counts, cholesterol, glucose, and total protein levels in comparison with age. The study included 107 men from college of science at Basrah university (52) smokers and (55) nonsmokers aged 20-50 years old. The results showed that hemoglobin concentrations was greater in smokers group over 40 years old compared with non smokers group for the same age, the same results have seen in smokers group over 20 years old compared with nonsmokers group for the same age, but no significant effect on smokers group over 30 years old compared with nonsmokers for the same age. Red blood cell counts was significantly abnormal lower in 20-50 years of age smokers group compared with the same ages of nonsmokers. White blood cell counts was significantly abnormal higher in 30-50 years of age in smokers group compared with nonsmokers group for the same age, there was a high significant difference ($p > 0.05$) in smokers group over 20 years old compared with control group of the same age. Cholesterol levels has no significant changes in both two groups for the same ages. Whereas glucose level showed no significant differences ($p < 0.05$) in all experiment groups. Total protein showed high significant differences in smokers serum in groups of 20-50 years old compared with nonsmokers group for the same ages. Conclusion: The results conclude that the smoking altered the physiological functions and this alterations was more progress with advance in age.

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Introduction

Cigarette smoking contributes to the development or progression of numerous chronic and age-related disease processes, but detailed mechanisms remain elusive(1). One major risk factor for morbidity and mortality among adults is smoking, today the relationship between smoking and cardiovascular disease and lung cancer is well established, cigarette smoking responsible for 90% of lung cancer cases among men, smoking accounts for about 30% of all cancer death(2). One of the major risk factors that cannot be changed which associated with heart disease is age, smokers who are still relatively young can reverse some lung damage by quitting, but in middle-aged and older smokers some damage seems to be irreversible(3). Medical studies have established that overall mortality is twice as high among middle-age men who smoke as among those who do not, one of the greatest dangers of smoking is the increased risk of cancer, particularly lung cancer, but also cancer of the bladder, mouth, and esophagus(4). Additionally, smokers have a fivefold increased risk of cancer of the larynx and oral cavity, but one third of all cancers of the kidneys and pancreas are attributed to smoking as well(5). The risk of smoking having a heart attack is more than twice that of nonsmokers and smokers risk for sudden cardiac death is two to four times the risk of nonsmokers(2). Statistical reports, in reference to the rate of heart attacks and arteriosclerosis, indicate multiplied numbers of incidences among smokers(3-6). Smoking cessation becomes more difficult when the habit is developed early in life because of the nicotine tolerance that is built up through years of smoking, hence prevention efforts must target young adults before they ever begin smoking (2). White blood cell count has been associated with coronary heart disease, its biomarkers of active pathogenesis and other oxidative damage at the tissue levels increasing in age was significantly associated with higher hemoglobin concentrations and lower total protein concentrations but there was no significant association with leukocyte count, smoking was significantly associated with higher hemoglobin concentrations, leukocyte counts and lower total protein concentrations(7). The aim of this study: to examine age-related change and cigarette smoking in the strength of the association of hemoglobin concentrations, red blood cell count, white blood cell count, serum glucose, serum total cholesterol, and serum total protein levels with features of metabolic syndrome found a relationship between cigarette smoking and these hematological and biochemical factors that could be involved in the pathophysiological disorders in smokers men and might represent markers of this disorder.

Material and Methods:

Across-section study conducted including some blood contents (hemoglobin concentrations, red blood cell counts, white blood cell counts, random serum glucose, serum total cholesterol, and serum total protein) in relation to cigarette smoking with demographic characteristics included age 107 healthy men volunteers from college of science at Basrah university (smokers(52) and nonsmokers(55)) were stratified by age into three groups of 20-29, 30-39, 40-49 years. All subjects were free of other cardiovascular risk

factors(i.e.,hypertention, diabetes, low H.D.L.cholesterol or vascular disease) and were not taking any medications,the last meal before taking samples was 2-3 hours.

Laboratory investigation:5 ml blood samples were obtained, serum was obtained by centrifugation of 4 ml of blood for biochemical tests and 1 ml of blood in EDTA test tube for hematological tests.

Biochemical investigation: random glucose,total cholesterol,and total protein were determined on serum by using commercially available kits(STC Technologies sigma).

Hematological investigation:Heamoglobin concentrations,red blood cell counts,and white blood cell counts were determined on blood with anticoagulant test tube for all groups(8).

Statistical analysis:

The statistical analysis was carried on using one-way ANOVA test analysis to evaluate the association between smoking status and the development of hemoglobin concentrations,red blood cell counts, white blood cell counts, cholesterol,glucose,and total protein levels,Data were adjusted first for age alone, then for the following multiple covariates. Revised L.S.D. test analysis used to analyze the statistical differences among participant characteristics at enrollment according to smoking status and the differences between all groups. The diagrams made by Microsoft Excel program.

Results:

Hemoglobin concentrations showed significant differences ($p < 0.05$) in smokers groups compared with nonsmokers group (Fig.1 and table 1), in nonsmokers men hemoglobin concentrations were normal no significant($p > 0.05$)but in smokers men it were significant($p < 0.05$), as comparison between smokers and non smokers groups a significant ($p < 0.05$)different clear between two groups according to age, the concentrations was high in smokers group over 40 years old (19 ± 4.243 ,mean \pm S.D.)gm% compared with nonsmokers group for the same age(15.5 ± 0.522 ,mean \pm S.D.)gm%,also in smokers group over 20 years old (16.875 ± 2.655 ,mean \pm S.D.)gm% compared with (15.2 \pm 2.449,mean \pm S.D.)gm%, but no significant(nonsmokers group for the same age ($p > 0.05$) different on smokers group over 30 years of age compared with nonsmokers for the same age.

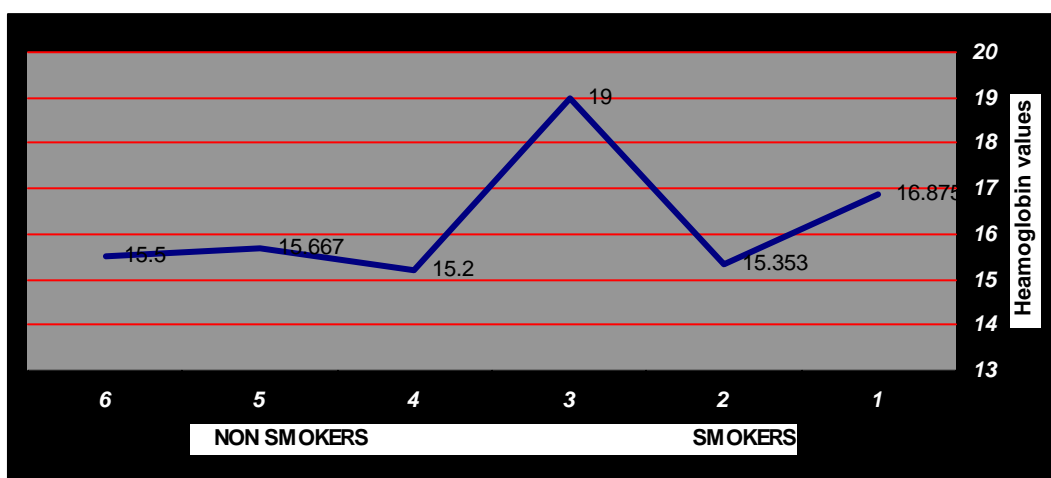
Table 1: Hemoglobin concentrations in smokers and non smokers men according to age($p < 0.05$).

AGE (YEARS)	N=	HEMOGLOBIN CONCENTRATION (g/dl) mean \pm S.D.
Smokers 20-29	16	16.875 \pm 2.655
30-39	17	15.353 \pm 2.978
40-49	12	19.000 \pm 4.243

Nonsmoker 20-29	25	15.200 ± 2.449
30-39	18	15.667±2.425
40-49	12	15.500 ± 0.522 ;1

RLSD=0.733 the heamoglobin concentrations has acute high in smokers 40-49yr compared with smokers 30-39yr(3.647,20-29yr(2.125)and non smokers20-29yr(3.8) 30-39yr(3.333) and nonsmokers 20-29yr(1.675),30-39yr(1.208) and 40-49yr(1.375) ,high significant different between smokers 30-39yr and nonsmokers for the same age(1.314).

Fig. 1:Heamoglobin concentrations in smokers and nonsmokers men according to age.



Red blood cell counts as in table 2 & Fig.2 were significantly abnormal lowered($p < 0.05$)in 20-29yr of age smokers group($2908667 \pm 891675, 3028667 \pm 483409, 311000 \pm 218341, \text{mean} \pm \text{S.D.}$)cell/ml³ of blood compared with the same ages of nonsmokers group($4440800 \pm 212778, 4476667 \pm 67910, 4630000 \pm 31334, \text{mean} \pm \text{S.D.}$) cell/ml³ of blood.

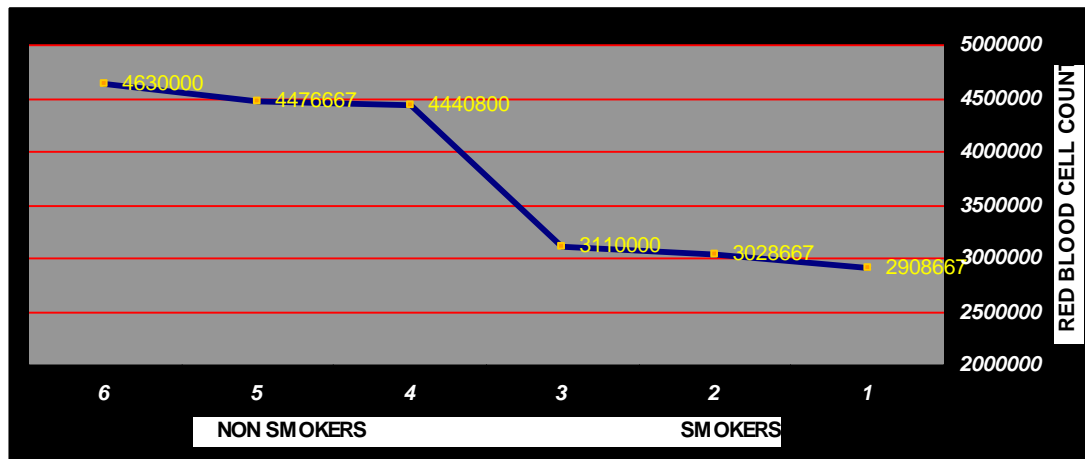
Table 2 :Red blood cell count in smokers and nonsmokers men according to age($p < 0.05$).

AGE (YEARS)	N	RED BLOOD CELL count (Million Cells/m³) mean ±S.D.
Smokers 20-29	15	2908667±891675

30-39	15	3028667± 483409
40-49	12	3110000±218341
Nonsmokers 20-29	25	4440800± 212778
30-39	18	4476667±67910
40-49	12	4630000 ±31334

RLSD=365239 as in no signioficant different($p>0.05$)in red blood cell count according to age in the same group ,but the different were clear between smokers and nonsmokers ,the results had acute different between nonsmokers 40-49yr and smokers age20-29yr(1721333),30-39yr(1601333)&40-49yr(1520000),also there were a different in nonsmokers 30-39yr compared with smokers age 20-29yr(1568000),30-39yr(1448000)&40-49yr(1366667),the differences were clear nonsmokers age 20-29yr compared with smokers age20-29yr(1532133),30-39yr(1412133)&40-49yr(1330800).

Fig.2 : Red blood cell count in smokers and nonsmokers men according to age.



White blood cell counts as in Table 3 &Fig. 3 were significantly abnormal high($p<0.05$)in 30-39rof age smokers group(11440±12172;13750±3668,mean±S.D.)cell/ml3 of blood compared with nonsmokers groups for the same ages(8933±3177;7875±653,mean±S.D.)cell/ml3 of blood alternatively,and significantly normal high in the smokers group but over 20 yr of age(6665±3131,mean±S.D.)cell/ml3 of blood compared with nonsmokers for the same ages(5127±1229,mean±S.D.)cell/ml3 of blood.

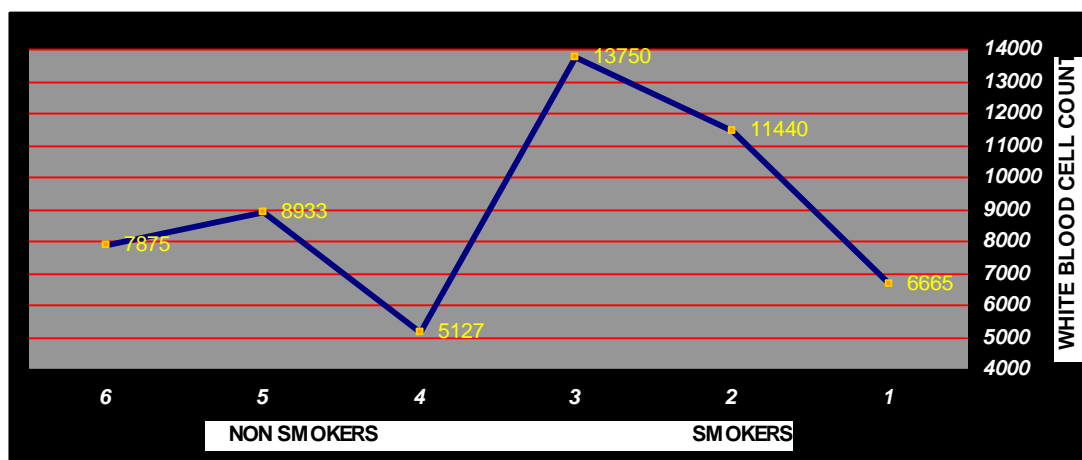
Table 4: White blood cell count in smokers and nonsmokers men according to age ($p<0.05$).

AGE (YEARS)	N	WHITE BLOOD CELL count (Cells/m13) mean ±S.D.
Smokers	15	6665 ±3131

20-29		
30-39	15	11440 ± 12172
40-49	12	13750±3668
Nonsmokers		
20-29	25	5127± 1229
30-39	18	8933±3177
40-49	12	7875 ±653

RLSD=1459 as in showed high different in white blood cell count in smokers age 40-49yr compared with smokers 20-29yr(7085),30-39yr(2310) and nonsmokers ages20-29yr(8623),30-39yr(4817)&40-49yr(5875),alsothere were different between smokers 30-39yr compared with smokers 20-29yr(4775),& nonsmokers age 20-29yr(6313),30-39yr(2507) & 40-49yr(3565),different between nonsmokers group 30-39yr & 20-29 yr were (2268),smokers20-29yr were(3806),also different between nonsmokers 20-29yr & nonsmokers 40-49yr(2748),the results showed close diffrents between smokers 20-29yr& nonsmokers for the same age(1536).

Fig 3: White blood cell count in smokers and nonsmokers men accoeding to age.

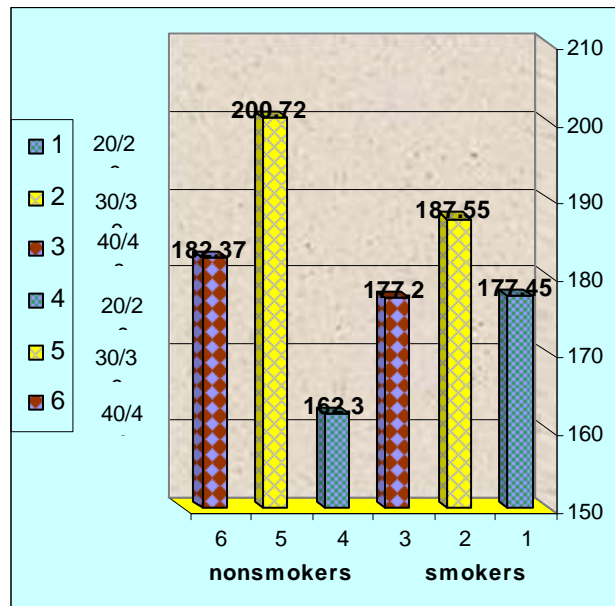


Cholesterol levels as in table 4 & fig. 4 had nosignificant(p>0.05) changes in both two groups according to age.

Table 4 & Fig. 4 :Serum cholesterol in smokers and nonsmokers men according to age(p<0.05).

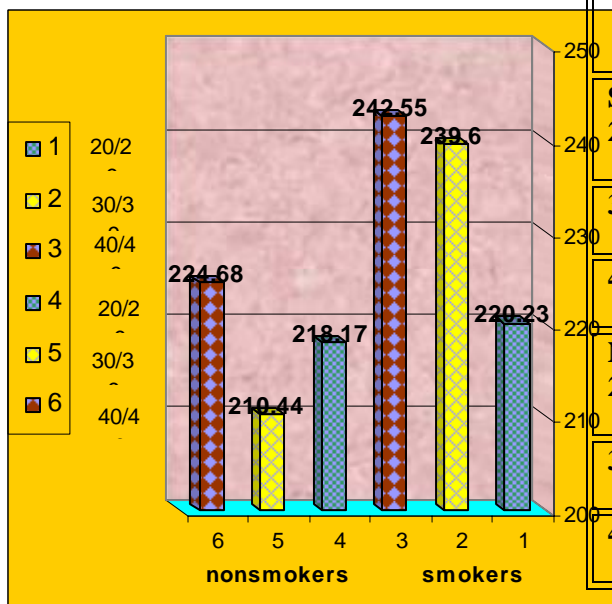
Smokers	N=	SERUM CHOLESTEROL (mg/dl) mean±S.D.
20-29	11	177.45 ± 66.06
30-39	15	187.55 ± 59.34
40-49	15	177.20 ± 27.05

Non smoker	22	162.30 ± 54.30
30-39	18	200.72 ± 26.83
40-49	12	182.37 ± 22.98



Glucose levels showed no significant differences ($p > 0.05$), and all the samples showed highly levels of glucose levels as in table 5 & fig. 5.

Table 5 & Fig. 5 :Random serum glucose in smokers & nonsmokers men according to age($p < 0.05$).



AGE (YEAR)	N =	SERUM GLUCOSE (mg/dl) mean±S.D.
Smoker 20-29	11	220.23 ± 88.43
30-39	17	239.60 ± 104.18
40-49	15	242.55 ± 78.82
Nonsmoker 20-29	18	218.17 ± 55.51
30-39	18	210.44 ± 113.98
40-49	12	224.68 ± 125.05

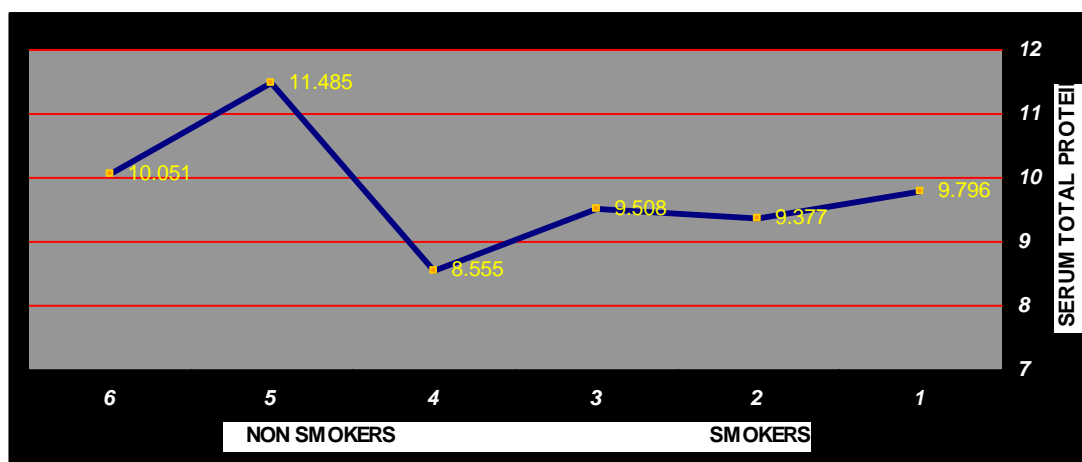
The total protein revealed high significant ($p < 0.05$) levels as in table 6 & fig. 6 in smokers serum 20-49yr of age (9.796 ± 1.329 ; 9.377 ± 2.027 ; 9.508 ± 0.895 , mean ± S.D.) g/dL compared with nonsmokers groups for the same ages (8.555 ± 0.369 ; 11.485 ± 2.167 ; 10.05 ± 0.173 , mean ± S.D.) g/dL.

Table 6 :Serum total protein in smokers & nonsmokers men according to age($p < 0.05$).

AGE (YEAR)	N =	SERUM TOTAL PROTEIN (G/DL) mean±S.D.
Smoker 20-29	16	9.796 ± 1.329
30-39	17	9.377 ± 2.027
40-49	18	9.508 ± 0.895
Nonsmoker 20-29	22	8.555± 0.869
30-39	18	11.485 ± 2.167
40-49	12	10.051 ± 0.173

RLSD=0.3703 there were different between smokers and nonsmokers groups, slight decrease in smokers age 20-29yr compared with smokers age 30-39yr(0.419),also different clear in nonsmokers age 20-29yr compared with smokers ages: high different with age 20-29yr(1.241) but less with age 30-39yr(0.822)& age 40-49yr(0.953),there was differences between nonsmokers age 40-49yr and: smokers for the same age(0.545) ,age 30-39yr(0.674),also higher different with nonsmokers age 20-29yr(1.496),also great different between nonsmokers 30-39yr , all others groups: with nonsmokers high different age 20-29yr (2.93) & age 40-49yr (1.427),also with smokers age 20-29yr (1.689) ,30-39yr (2.108) & 40-49yr (1.977).

Fig. 6 : Serum total protein in smokers and nonsmokers men according to age.



Conclusion: Cigarette smoking in men seem to be associated with pathophysiological disorder in heamoglobin concentrations, red blood cell counts, white blood cell counts, cholesterol, glucose, and total protein levels comparing with nonsmokers men & this disorder increased with aging in cigarette smoking men blood in middle-age Iraqi men.

Discosion:

A few studies Iraq investigated the relation between cigarette smoking and physiological disorder specially according to age. The prevalence of cigarette smoking in these subjects has been documented and it is of interest to observe the influence this habit has in early life on some possible risk factors for coronary heart disease (9). The present study indicates that cigarette smoking caused pathophysiological disorder in haemoglobin concentrations, red blood cell count, white blood cell count and serum total protein levels comparing with non smokers men and this disorder increased with aging in cigarette smoking men. Little is known about the longitudinal changes of haemoglobin. Both high or low haemoglobin levels increase mortality and morbidity, smoking cessation lowered mean haemoglobin 1.6 g/l compared with never smokers (10). Human red blood cells are important targets for electrophilic and oxidant foreign compounds (5). Hemoglobin is a protein with iron containing prosthetic groups, it is the red oxygen-carrying pigment in the erythrocytes of the blood (6). Our haemoglobin analysis showed a significant increasing haemoglobin concentrations with increasing age in cigarette smoking men, other studies support that (7-11), which found that increasing age was significantly associated with higher haemoglobin concentrations and smoking was significantly associated with higher haemoglobin. (2) found out that smoking cessation becomes more difficult when habit is developed early in life because of the nicotine tolerance that is built up through years of smoking this mean cigarette affect on haemoglobin in smokers men blood with increasing age. In cross sectional studies haemoglobin levels declines with increasing age in healthy young men (10). Two of the most dangerous components of tobacco smoke are *carbon monoxide*, (CO), a gas and particulate substances (including nicotine), which are collectively known as *tar* (3-6). Carbon monoxide (CO) had high affinity for haemoglobin than oxygen and is a common cause of poisoning in CO by age, smokers showed significantly higher exhaled CO levels compared with non smokers and older subjects had lower exhaled CO levels compared with young subjects (12). In the blood, carbon monoxide interferes with the supply of oxygen to all tissues and organs, including the brain and heart. The released carbon monoxide entering the blood-stream combines with the *hemoglobin* to form *carboxyhemoglobin* (3). The amount of free hemoglobin to bind and transfer oxygen to the body becomes less, thus resulting to oxygen deficiency for many vital tissues. Carbon monoxide can reduce an adequate physiologic response the problem is that carbon monoxide had 200 times more affinity for haemoglobin than oxygen this combination decreases oxygen at the tissue level which intern resulting functional anemia (13), this may explain the significant acute abnormal haemolysis by the low number of red blood cell count of our results in smokers groups only but not in non smokers, this agree with (14), in contrast (15) found that the blood erythrocyte count is increased in smokers. (5) found that erythrocyte membrane lipid peroxidation EMLP in smokers were significantly higher than the control levels erythrocyte superoxide dismutase SOD activity was diminished in smokers compared to nonsmoker controls Erythrocyte Se-GPx selenium dependent glutathione peroxidase activity was also found significantly diminished in smokers found that the erythrocyte glutathione S-transferase GST activity is significantly lower in young adult smokers it can be concluded that the decrease in GST activity leads to extra OST synthesis during erythrocyte proliferation. (14) found cigarette smoke contains many pro-oxidants that contribute directly to oxidative stress, polyunsaturated fatty acids are very susceptible to oxidative effects of free radicals thus, smoke-induced oxidative stress could plausibly account for reductions in membrane fatty acid. One of the important cause of haemolysis is the membrane of erythrocytes, any changes in this membrane in shape or in components will cause destruction to the cell which cause haemolysis.

White blood cell count was significantly associated with smoking (16). In our study, white blood cell counts in smokers showed high abnormal significant in men aged 20-49 yr compared with nonsmokers for the same ages, this findings agree with several studies (17) stratified analyses by smoking and age showed that in both nonsmokers and smokers the adjusted WBC count increased as the number with aging and this is more pronounced in younger individuals in both nonsmokers and current smokers (18) found out that white blood

cell counts in smokers had an average of approximately 200 white blood cells / μ l higher than those who never smokers. (15) found that the blood leukocyte concentration is increased by as much as 30% in smokers, its because the biologic mechanisms for a persistent effect of smoking in white blood cell count, have been proposed ,such as a residual chronic inflammation of the bronchial tree due to smoking(19). (17) found that smoking in men are associated with WBC count and these tendency is more pronounced in younger individuals in both non smokers and current smokers,(18) found that smokers have higher white blood cell counts than nonsmokers the strength of the association has led to the suggestion that the white blood cell count provides a better indicator of cigarette smoking(14) WBC count is a marker of oxidant load like age, high tracking in WBC count suggests an individual predisposition to the oxidative damage, invariant over time.(7)found out that increasing age was no significantly associated with leukocyte count but smoking had a significant higher association with leukocyte count .(17)found that WBC counts increased in those aged 23-39 yr in both non smokers and current smokers but the largest were in the youngest age group may be because of the age weakened.), the relation of high WBC count with smoking could be due to the presence of a sub clinical inflammatory reaction (17). However, the cross-sectional study design lacks information on the time sequence of events and, thus, does not permit identification of causal relationships. Further studies are needed to clarify whether WBC count, although within the normal range, contributes to the smoking and whether there are age differences in the strength of the association of WBC count with the features of smoking (17).

The literature on the effects of cigarette smoking on blood glucose is inconclusive (20).Our results showed no significant but abnormal high levels of serum random glucose in both smokers and non smokers men although in smokers the values were slightly high than non smokers similar results were reported by(21) found no effect of smoking on blood glucose levels. On the other hand, (15-20) found the blood glucose concentration is higher in smokers than nonsmokers.(22) Found out that blood glucose decreased in smokers compared with non smokers,the present results showed that the levels of glucose increased gradually with aging in smokers.(23)found that smoking independently associated with increased risk of type 2 diabetes among both middle- aged and elderly men .(20)found out that nicotine has been demonstrated to increase plasma levels of norepinephrine and epinephrine.This increase in catecholamines is followed by an increase in heart rate and blood pressure as well as other changes attributed to increased adrenergic activity following cigarette smoking. None of these changes, however, can be directly linked to atherosclerosis in humans.Increases in plasma catecholamines have been known to cause increased hepatic glycolysis and gluconeogenesis and decreased pancreatic insulin secretion in humans, leading to increased plasma glucose. One would expect, then, that cigarette smoking would lead to increased plasma glucose levels, especially when nicotine levels are high.

The present results found random cholesterol levels had no significant differences in both two groups smokers and non smokers they were in the normal rang for all ages groups, (9)found that fasting serum cholesterol was higher in younger smoking and non smoking men indicated that smoking had no effect on serum cholesterol but nutritionstyle may be had, on the other studies (15),found that total cholesterol was high in smokers compared with non smokers , otherwise, (22)found that smokers had less total cholesterol than non smokers.

The present results showed a significant abnormal high levels of serum total protein in smokers aged 20-49 yr. in the other hand,(7)found out that smoking was significantly associated with lower total protein concentrations. Whether (22) found that total protein had no variation in smokers and non smokers blood. It is interesting to note that, in our present study healthy non smokers men aged 30-49 yr had significant high levels of serum total protein may be that because of there nutrition style, but comparing with smokers for the same age may be cigarette smoking had effect on total protein specially it was normal in non smoking 20-29 age men but it raised abnormally in 30-49 yr so increasing age effect on serum

total protein in healthy non smokers men lecturers and students. In contract,(7).found that, increasing in age was significantly associated with lower total protein concentration.

Conclusions:

This study found pathophysiological effect of cigarette smoking male aged 20-49yr in collage of science basrah university in haernoglobin concentrations, abnormal decreased number of red blood cell ,the abnormal high number of white blood cell and the abnormal increased levels of total protein specially in middle-age men we found that the serum total protein in non smokers men of collage of science basrah university aged 30-49 was abnormal very high levels compared with smokers men.

Study

First, regular laboratory investigations from adult smokers specially middle-age men of haemoglobin,red blood cell count ,white blood cell count and serum total protein. Second, basrah university requires health warning be printed on broadcast media and literature aimed at helping the smokers to stop smoking. Third, prevention efforts must target young adults before they ever begin smoking. forth, in the present model .all subjects were male, therefore, additional investigations well be required to establish whether the serum from female smokers would have similar effects as in male. Fifth, more studies about age and smoking especially among children and old people. Sixth, pathohistological studies needed for both male and female in this field. Third further studies as pathophysiology or pathohistology on effect of exhaled and negative smoking on health .seventh, non smokers 30-49yr men in collage of science Basrah University must check there serum total protein.

limitations:

Acknowledgments:

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