Effect of Tobacco Consumption on Red Cell Indices in Tobacco Users

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In the recent decades a massive global increase in tobacco use has been seen. Immediate availability and the low price gives rise to high consumption of tobacco and causes alteration of hematological parameters. Alterations of these parameters are associated with a greater risk for developing chronic pulmonary diseases and cardiovascular diseases. To observe the effects of tobacco consumption on PCV, MCV, MCH and MCHC in tobacco users. This cross sectional study was conducted from July 2014 to June 2015 in the Department of Physiology, Rangpur Medical College, Rangpur. A total number of 100 subjects were selected, among them 50 were apparently healthy non-tobacco chewer non-smoker subjects as control group (group A) and 50 were apparently healthy tobacco chewer and smoker subjects (group B)). The subjects were selected from Rangpur city. For statistical analysis independent sample "t" test was performed by computer based software SPSS-17.0 version for windows. PCV and MCH were significantly higher ($p<0.001$), non significant difference ($p>0.05$) of MCV and MCHC in tobacco users as compared with the healthy control subjects. There is association between tobacco consumption and alteration of red cell indices.

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Key words: Smoking, Smokeless tobacco, Red cell indices

Introduction

Tobacco products including chewing tobacco, snuff, cigarettes, cigars and loose pipe tobacco contain the dried, processed leaves of the tobacco plant Nicotiana rustica or Nicotiana tabacum.[1] There are two kinds of commonly used tobacco products in Bangladesh i.e. smoking and smokeless tobacco products. Traditionally Bangladeshi men smoke cigarettes, bidi and chew tobacco leaf as zarda, sada pata, gul, khoinee as smokeless form. However, women usually consume smokeless tobacco more than tobacco in smoked form.[2] All forms of tobacco contain nicotine, an extremely addictive substance that can act as both a central nervous system stimulant and depressant.[1] In addition to nicotine, tobacco contains thousands of other chemicals such as cresol, pyrene, DDT, carbon monoxide, ammonia, hydrogen cyanide, acetone, methanol, formaldehyde, arsenic, cadmium etc.[2]

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In Bangladesh 43.3% of adults (41.3 million) use tobacco in smoking and or smokeless form. Among them, 26.4% of men, 27.9% of women and 27.2% overall (25.9 million adults) use smokeless tobacco. On the other hand, 44.7% of men, 1.5% of women and 23.0% overall (21.1 million adults) use smoked tobacco. More than five million people die globally each year due to tobacco related illness, the figure expected to increase to 8.3 million by 2030.[3] Tobacco consumption in any form has negative consequences on health and it has become a significant public health concern around the globe.[4] Tobacco use has both acute and chronic effect on RBC indices. Alteration of these parameters might be associated with a greater risk for developing atherosclerosis, polycythemia vera, chronic obstructive pulmonary disease and or cardiovascular diseases.[5,6]

Consumption of tobacco is now increasing rapidly throughout the developing world and is one of the biggest threats to current and future world health.[7] Because of vigorous efforts toward increase awareness of adverse effects of tobacco, smoking has declined consistently over the last few years, paradoxically the use of smokeless tobacco and snuff has greatly increased.[8] Since 1990, WHO and the U.S. Centers for Disease Control and Prevention (CDC), along with their partners, have worked together to implement the Global Tobacco Surveillance System (GTSS). Bangladesh has been implementing surveys under GTSS since 2004 regularly at periodical intervals.

Awareness of the ill effects of tobacco use spread all over the world. As a result, the Cigarettes & Other Tobacco Products Act of 2003 was passed, which states the following: Prohibition of direct & indirect advertising of tobacco products; Prohibition of smoking in public places; Prohibition on sale of tobacco to persons below 18 years of age; Prohibition on sale of tobacco within a radius of 100 yards of educational institutions; Warnings on tobacco packaging carrying the ill effects of tobacco.[3]

According to the official Agricultural Statistics (2010) three varieties of tobacco-Jati, Motihari and Virginia – are grown in different districts of Bangladesh. Rangpur still remains highest with 40,345 acres during 2008-2009.[9]

The purpose of this study was to asses the effects of tobacco on some hematological parameters of tobacco users of northern region because the rate of tobacco use is more among the people of this region. As far as our knowledge, this kind of study is not previously done in our country. This study would increase awareness about the adverse hematological effects of unjudicial tobacco use.

Methods

The Cross-sectional analytical study was conducted in the Department of Physiology, Rangpur Medical College, Rangpur from July 2014 to June 2015.The Rangpur Medical college ethical committee and thesis protocol review committee approved the study protocol. Total number of 100 apparently healthy subjects with age 20-40 years were divided into following groups: Group-A (Control 50): Apparently healthy subject of non-tobacco chewers non smokers and Group-B (Experimental 50): Apparently healthy subject of tobacco chewers and smokers. The subjects included in each group matched in their age and socio-economic condition. The duration of smoking and or chewing is more than three years All the subjects were free from history of bleeding disorders, diabetes mellitus, hypertension or any acute infection, history

of any recent medication like aspirin, steroid or non-steroidal anti- inflammatory drugs.

After selection of subjects, the objectives and the procedure of the study were explained in detail to them and their informed written consent were taken. A standard questionnaire was filled after taking history and through clinical examinations. At the first day all study procedures were maintained and advised the subjects to be in overnight (8-10 hours) fasting state. Then attended next day at 8.00 A.M. at the Department of Physiology, Rangpur Medical College, Rangpur. Fasting venous blood sample was collected from the subjects. Five ml of blood was collected from antecubital vein from each subject under all aseptic precaution by a disposable syringe. The needle was detached from the nozzle and blood was immediately transferred into two set of test tubes with gentle push to avoid hemolysis. For hematological analysis, blood sample was collected in a test tube containing EDTA (ethylene diamine tetra acetate, an anti-coagulant) and immediately taken to the laboratory. Then RBC indices were studied with an automatic electronic blood count analyser at the Department of Biochemistry, Rangpur Medical College, Rangpur.

For statistical analysis independent sample "t" test was performed by computer based software SPSS-17.0 version for windows

Results

The data depicted in Table I shows an alteration in the hematological parameters in tobacco users than those of healthy control subjects. In this cross sectional study, PCV and MCH are significantly higher ($p<0.001$) and non significant difference in MCV and MCHC in tobacco users than those of healthy control subjects.

Table I: Mean ± SD PCV, MCV, MCH and MCHC in two groups

Variables	Control (non-tobacco chewers non smokers) Mean ± SD	Tobacco smokers and /chewers Mean ± SD	p value
PCV %	38.67 ± 2.65	42.13 ± 3.93	0.000***
MCV fl	79.168 ± 7.71	79.54 ± 7.15	0.966^{NS}
MCH pg	25.398 ± 1.89	26.53 ± 2.48	0.032*
MCHC gm/dl	32.826 ± 1.14	33.26 ± 1.08	0.134^{NS}

A=Apparently healthy subjects of non-tobacco chewer non-smoker (Control).
B= Apparently healthy subjects of tobacco chewers and smokers (Experimental).
n= Number of subjects.
***= $p<0.001$,
*= $p<0.05$, NS= $p>0.05$

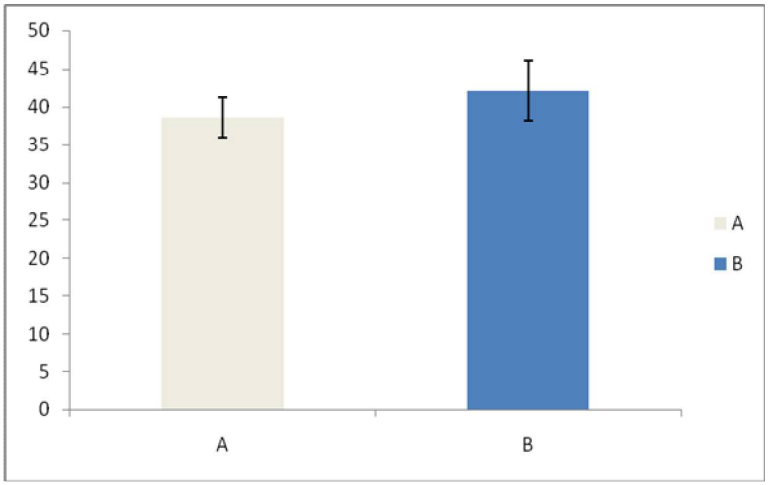

Figure 1. Bar diagram showing mean (± SD) PCV in group A (control) and group B (experimental)

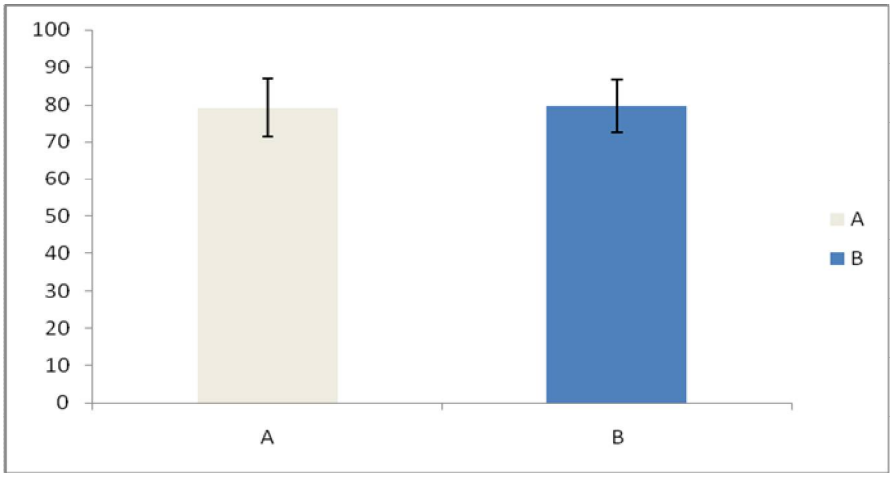

Figure 2. Bar diagram showing mean (± SD) MCV in group A (control) and group B (experimental

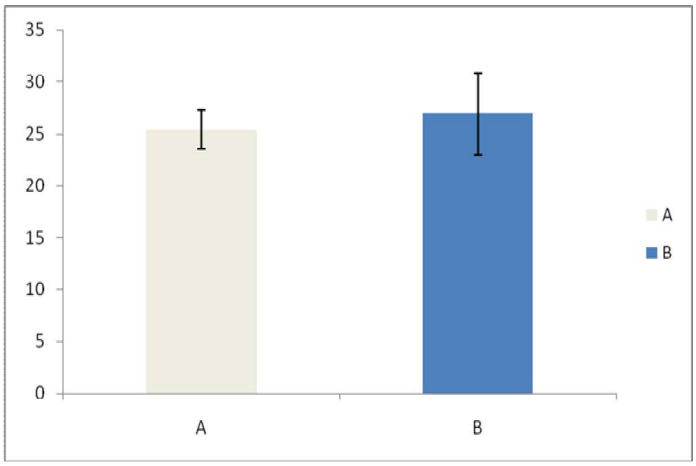

Figure 3. Bar diagram showing mean (± SD) MCH in group A (control) and group B (experimental)

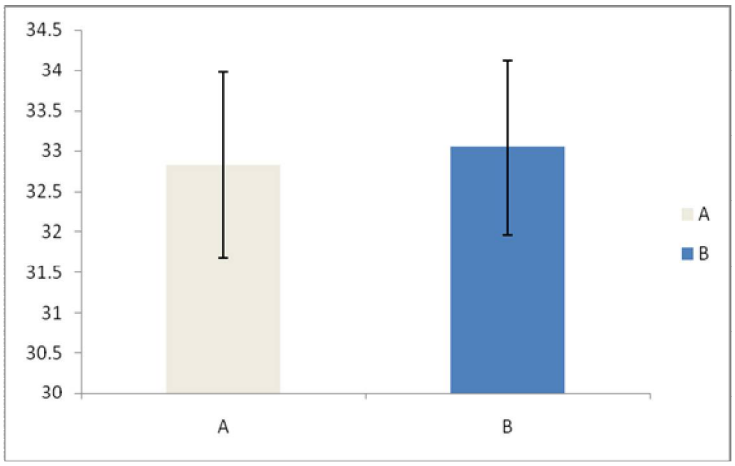

Figure 4. Bar diagram showing mean (± SD) MCHC in group A (control) and group B (experimental)

Discussion

In this cross sectional study, PCV and MCH are significantly higher in tobacco users than those of healthy control subjects which is comparable to others.[5,6,10,12] Again, in the present study non significant difference of MCV and MCHC is found in tobacco users[8,14,15] which is also reported by others.

Literature review suggested several mechanisms for these changes of PCV and MCH in tobacco users. In this study, higher levels of PCV and MCH in tobacco chewer and smoker subjects may be due to in cigarette smoking, carbon monoxide (CO) is produced by the incomplete combustion of carbon-containing material which has a very high affinity for haemoglobin. CO bind with haemoglobin and form carboxy- haemoglobin which reduce not only oxygen-carrying capacity but also inhibits oxygen release from haemoglobin. The resulting chronic tissue hypoxia stimulate erythropoietin secretion and increase erythropoiesis that leads to increase hematocrit value and MCH in tobacco smokers.

Numerous oxidants such as superoxide anions, hydroxyl radicals, H_2O_2 and HOCL present in tobacco that interacts with various biomolecules like DNA, RNA, lipids, amino acids, proteins, glutathione, α_1–antiprotease causes inflammation and injury of the lungs. Insufficient pulmonary function produces chronic tissue hypoxia which stimulates erythropoiesis for fulfilling the oxygen demands of the body. This leads to increase hematocrit value and MCH in tobacco chewers.

Mean corpuscular volume (MCV) of red cells smaller or larger than normal size indicates the person had anemia. Increased MCV means the subjects might be suffering from megaloblastic, hemolytic, pernicious or macrocytic anaemia usually caused by vitamin B-12 or folic acid deficiency. Decreased MCV means the subjects might suffer from microcytic anaemia due to iron deficiency. In this study, no significant effects on MCV may be due to iron, folic acid or vitamin B-12 deficiency anaemia was not developed in tobacco users. MCHC denotes the amount of haemoglobin in a specific volume of packed red cell. As the PCV and Hb concentration increased proportionately, So, non-significant increase of MCHC may occur in tobacco users.

Conclusion

From the results of the present study, it has been concluded that tobacco combustion products (CO) as well as numerous oxidants present in tobacco stimulates erythropoiesis leading to increase hematocrit value in tobacco users. Throughout the study, it is clear that there is association between tobacco consumption and alteration of the red cell indices.

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