https://doi.org/10.3329/cbmj.v15i1.87624

Study on Relationship between Cigarette Smoking and Hemoglobin Levels in a Healthy Adult Bangladeshi Male Population

*Naznin R

Abstract

A cross-sectional, comparative study was conducted in the Outpatient Department (OPD) of Mymensingh Medical College Hospital, Mymensingh, Bangladesh, from July 2014 to June 2015, to observe the relationship between cigarette smoking and hemoglobin levels in healthy adult male population. We studied on a total of 150 participants, comprising 50 non-smokers (group-I) and 100 smokers (group-IIA with 5-10 years duration of smoking and group-IIB >10 years duration of smoking). Hemoglobin concentration was measured using the cyanmethemoglobin method. A questionnaire including data was completed in all cases. The survey data were checked, coded, and analyzed. Hemoglobin levels were found increased with the duration of smoking in both study groups, i.e., group-IIA and group-IIB, as compared with the control group (nonsmokers, group-I) ($p<0.001$). Hemoglobin levels were also found increased in group IIB as compared to group IIA ($p<0.05$). Our study showed that cigarette smoking has a strong influence on hemoglobin concentration in smokers, which increases hemoglobin levels in blood.

CBMJ 2026 January: vol. 15 no. 01 P:144-147

Keywords: Hemoglobin, cigarette smoking, healthy adult, Bangladeshi population

Introduction

The blood hemoglobin estimations are one of the most frequently used laboratory parameters in clinical settings. Hemoglobin values, however, vary with age, sex, stage of pregnancy, ethnicity, altitude, and smoking.[1] Smoking-induced hypoxia, inflammation, and oxidative stress result in impairment of hematological parameters.[2] Smoking was regarded as the cause of one/third of all cancer deaths worldwide.[3] About 1.3 billion people are regular smokers worldwide, and every day between 8200 and 9900 young people start to smoke, risking rapid addiction to nicotine.[4] If the current trend of smoking continues, the World Health Organization (WHO) estimates that by 2030, the annual death toll will rise to about 10 million.[5] The rate is much higher in developing countries. Despite this high mortality rate, the number of smokers is also increasing every day. It is believed that there are 4.5 billion smokers in the world, and this will increase to about 7.1 billion by 2025.[6] Cigarette smoking has both acute and chronic effects on hematological parameters. There are more than 4000 chemicals found in cigarette smoke[7], and a cigarette smoker is exposed to several harmful substances, including nicotine, free radicals, carbon monoxide (CO), and other gaseous products.[8] The combination of carbon monoxide (CO) in tobacco with the effects of nicotine disrupts oxygen delivery to tissue and stimulates bone marrow to produce more RBCs and thereby increases hematocrit (HCT) and hemoglobin.[9] Since observational studies are usually prone to confounding and reverse causation, it is still uncertain whether tobacco smoking causally influences the hematopoietic system. This is an important question, as smoking is a potentially reversible risk factor, and if smoking is causally associated with the hematopoietic system, it can ultimately change the understanding of many hematologic diseases.[10] The present study investigates the relationship between cigarette smoking with hemoglobin levels in a healthy adult Bangladeshi male population.

*Dr. Rubiat Naznin, Associate Professor, Department of Physiology, Community Based Medical College, Bangladesh, Mymensingh.

Address of Correspondence:
Email: rubiatnaznin@gmail.com

Methods

The present study was conducted at Outpatient Department (OPD) of Mymensingh Medical College Hospital, Mymensingh, Bangladesh, from July 2014 to June 2015. This entire study was conducted in male subjects. Hemoglobin percentage among the cigarette smokers, compared with non-smokers in the age group between 20 and 55 years. A total of 150 voluntary subjects were selected on the basis of history and clinical examination. Among them, 50 participants were non-smokers who had never smoked any type of tobacco before. Intensity of cigarette smoking was determined in 100 smokers, of whom 50 were cigarette smokers for less than 10 years, and 50 were smoking cigarettes for more than 10 years. The subject's body weight was measured in kilograms and height in meters. Hemoglobin concentration was measured using the cyanmethemoglobin method. Individuals who smoke cigarettes daily for at least one year are considered smokers. Ex-smokers or past smokers were excluded from the study. Adults with a history of any acute or chronic illness, bleeding or bleeding disorders, and those who had donated blood within 6 months were not included in the study.

In data sheet, height, weight, and BMI (body mass index) were noted for each participant. Information about smoking habits was obtained by a questionnaire. With all aseptic precautions, a ml blood sample was collected from the antecubital vein and mixed immediately with 1.5 mg EDTA/ml of blood. From the drawn blood for estimation of hemoglobin, 0.02 ml of blood was sucked by a micropipette and poured into another test tube containing 5 ml of Drabkin's reagent (dilute 1 volume of reagent with 9 volumes of distilled water). The test tube was also labeled with the name of the subject, the date, and the time of collection. The intensity is measured at 540 nm, which is directly proportional to the amount of hemoglobin present in the specimen. It was taken as the data for the subject. Data was collected, compiled, coded and analyzed using Statistical Package for Social Sciences (SPSS) version 12.0. Data was expressed as mean±SD (standard deviation). Unpaired Student's t-test was used to calculate statistical differences among the groups. A p-value <0.05 was considered statistically significant. The study was approved by the Institutional Review Board of Mymensingh Medical College, Mymensingh, Bangladesh.

Results

In the present study, hemoglobin levels were found to increase gradually with the duration of smoking in the study groups, as compared to the control group. The mean hemoglobin level was 11.18±0.05 mg/dl in group-I, while 12.74±0.10 mg/dl and 12.83±0.08 mg/dl in group-IIA and group-IIB respectively. The differences were statistically highly significant (p=0.000) (Table-I). Although the mean hemoglobin level was a bit higher in group-IIB compered to group-IIA, the difference was not statistically significant (p=0.479) (Table-I).

Table-I: Comparison of mean hemoglobin levels (mg/dl) between non-smoker and different group of smokers (N=150)

Group I (n=50)	Group IIA (n=50)	Group IIB (n=50)	Mean Difference	t-Value	p-Value
11.18±0.05	12.74±0.10	-	1.55	13.27^{S}	0.000^{S}
11.18±0.05	-	12.83±0.08	1.64	17.72^{S}	0.000^{S}
-	12.74±0.10	12.83±0.08	0.09	0.711^{NS}	0.479^{NS}

Data was expressed as mean±SD. Unpaired Student's t-test was applied to reach p-value; S=significant, NS=not significant.

Discussion

The present study was carried out to observe the effects of cigarette smoking on hemoglobin levels in healthy adult male population. Two groups of subjects (study or smokers and control or non-smokers) were of comparable age, sex, and BMI. The study population was divided into a control group (group-I) and a study group (group-II), depending on smoking habits, that is, non-smokers and smokers respectively. Again, smokers (group-II) were divided into less than ten years of smoking duration (group-IIA) and more than ten years of smoking duration (group-IIB).

In our study, the mean hemoglobin level was 11.18±0.05 mg/dl in group-I, while 12.74±0.10 mg/dl and 12.83±0.08 mg/dl in group-IIA and group-IIB respectively. Hemoglobin levels were found to increase gradually with the duration of smoking in the study groups, as compared to the control group (p=0.000). Although the mean hemoglobin level was a bit higher in group-IIB compared to group-IIA, the difference was not statistically significant (p=0.479). Similar results were reported in two previous studies that hemoglobin levels were found significantly increased in smokers with increased duration of smoking and increased number of cigarettes smoked per day.[11,12] Malenica *et al*. also reported that cigarette smoking elevated hemoglobin levels in study participants.[13] Our results are also in congruence with the findings of Kahar *et al*. and Shah *et al.*[14,15]

An increase in hemoglobin concentration is believed to be mediated by exposure to carbon monoxide, and some scientists have suggested that an increase in hemoglobin level in the blood of smokers could be a compensatory mechanism. Carbon monoxide binds to hemoglobin to form carboxyhemoglobin, an inactive form of hemoglobin having no oxygen-carrying capacity. Carboxyhemoglobin also shifts the hemoglobin dissociation curve to the left side, resulting in a reduction in the ability of hemoglobin to deliver oxygen to the tissue. To compensate for the decreased oxygen-delivering capacity, smokers maintain a higher hemoglobin level than non-smokers.[16] Mean hemoglobin levels and carboxyhemoglobin levels increased progressively with the number of cigarettes consumed per day. Cigarette smoking seems to cause a generalized upward shift of the hemoglobin distribution curve, which reduces the utility of hemoglobin level to detect anemia.[17] Nicotine from cigarette smoking also induces the formation of a clot in the coronary arteries, weakens vascular activity, and increases endothelial dysfunction. An increase in the level of carboxyhemoglobin may cause hypoxia.[18]

Conclusion

In conclusion, we found that hemoglobin level was affected by smoking. We also found that the phenomena might be specifically related to duration of smoking in years and the number of cigarettes smoked per day. Prospective randomized controlled trials are needed to explain the possible reasons why hemoglobin level differs in this way between smokers and non-smokers. Smoking is a potentially reversible risk factor, and if smoking is causally associated with the hematopoietic system, it can ultimately change the understanding of many hematologic diseases. Therefore, hemoglobin concentration should be strictly considered during the diagnosis & treatment of diseases.

References

1. *Goel A, Deepak D, Gaur N. Study of relationship of tobacco smoking with haemoglobin concentration in healthy adults. J Pharma Biomed Sci. 2010;1:1-3.*
2. *Waseem SMA, Alvi AB. Correlation between anemia and smoking: Study of patients visiting different outpatient departments of Integral Institute of Medical Science and Research, Lucknow. Natl J Physiol Pharm Pharmacol. 2020;10(2):149-54.*
3. *Kibria MG, Islam AKMM, Rahman MM. Prevalence and determinants of smoking among young male patients coming at OPD in selected Hospital. Med Today. 2017;29(2):38-41.*
4. *Khan MI, Bukhari MH, Akhtar MS, Brar S. Effect of smoking on red blood cells count, hemoglobin concentration and red cell indices. Pak J Med Health Sci. 2014;8(2):361-4.*
5. *Kar D, Gillies C, Zaccardi F, Webb D, Seidu S, Tesfaye S, et al. Relationship of cardiometabolic parameters in non-smokers, current smokers, and quitters in diabetes: A systematic review and meta-analysis. Cardiovasc Diabetol. 2016;15(1):158.*
6. *Doll R, Peto R, Wheatley K, Gray R, Sutherland I. Mortality in relation to smoking: 40 years' observations on male British doctors. BMJ. 1994;309(6959):901-11.*
7. *Green A, Green CR, Rodgman A, Aynsley-Green A. The tobacco chemists' research conference. A half-century of advances in analytical methodology of tobacco and its products. Recent Adv Tobacco Sci. 1996;22:131-304.*
8. *Gitte RN. Effect of cigarette smoking on plasma fibrinogen and platelet count. Asian J Med Sci. 2011;2(3):181-4.*
9. *Roethig HJ, Koval T, Muhammad-Kah R, Jin Y, Mendes P, Unverdorben M. Short term effects of reduced exposure to cigarette smoke on white blood cells, platelets and red blood cells in adult cigarette smokers. Regul Toxicol Pharmacol. 2010;57(2-3):333-7.*
10. *Hasselbalch HC. Smoking as a contributing factor for development of polycythemia vera and related neoplasms. Leuk Res. 2015:S0145-2126(15)30373-8.*
11. *Ahmed IA, Mohammed MA, Hassan HM, Ali IA. Relationship between tobacco smoking and hematological indices among Sudanese smokers. J Health Popul Nutr. 2024;43(1):5.*
12. *Ahmed NJ, Husen AZ, Khoshnaw N, Getta HA, Hussein ZS, Yassin AK, et al. The effects of smoking on IgE, oxidative stress and haemoglobin concentration. Asian Pac J Cancer Prev. 2020;21(4):1069-72.*
13. *Malenica M, Prnjavorac B, Bego T, Dujic T, Semiz S, Skrbo S, et al. Effect of cigarette smoking on haematological parameters in healthy population. Med Arch. 2017;71(2):132-6.*
14. *Kahar F, Wikandari RJ, Irnawati I, Penmaley MS. The effect of cigarette smoking duration on hemoglobin level measured with cyanmethemoglobin method. Indones J Med Lab Sci Technol. 2022;4(2):157-67.*
15. *Shah BK, Nepal AK, Agrawal M, Sinha AK. The effects of cigarette smoking on hemoglobin levels compared between smokers and non-smokers. Sunsari Tech Coll J. 2012;1(1):42-4.*
16. *Aitchison R, Russell N. Smoking – A major cause of polycythaemia. J R Soc Med. 1988;81(2):89-91.*
17. *Nordenberg D, Yip R, Binkin NJ. The effect of cigarette smoking on hemoglobin levels and anemia screening. JAMA. 1990;264(12):1556-9.*
18. *Gossett LK, Johnson HM, Piper ME, Fiore MC, Baker TB, Stein JH. Smoking intensity and lipoprotein abnormalities in active smokers. J Clin Lipidol. 2009;3(6):372-8.*