ORIGINAL ARTICLE
ERYTHROCYTES INDICES IN MALE SMOKERS AND HEROIN ADDICTS

Muhammad Tariq, Riffat Sultana*, Amin Ul Haq**

Department of Physiology, Kabir Medical College, *Department of Physiology, Khyber Girls Medical College,
**Department of Biochemistry, Khyber Girls Medical College, Peshawar, Pakistan

Background: The harmful components of tobacco smoke nicotine, tar and carbon monoxide affect different haematological parameters. Heroin affects almost every system of the body including blood and its components. The objective of the present study was to compare the effects of cigarette smoking and heroin abuse on haematological parameters especially erythrocyte indices. **Method:** The present study was conducted in Physiology department; Khyber Medical College Peshawar from Jan 2006 to Dec 2007. One hundred age and sex matched subjects were included in the study. The subjects were divided into three groups, i.e., 40 cigarette smokers and 40 heroin addicts, with 20 controls. Data were statistically analysed using SPSS-10. **Results:** The mean haemoglobin value of cigarette smokers was significantly higher as compared to control subjects ($p<0.001$). The mean haemoglobin value of heroin addicts was significantly lower when compared with either control group or cigarette smokers ($p<0.001$). **Conclusion:** Haematological parameters vary with smoking and heroin abuse. There should be no illusions as to the dangers of cigarettes. The combination of a highly addictive, pharmacologically active substance–nicotine–and an array of noxious chemicals cunningly packaged in highly efficient delivery mechanism can drastically affect health.
Keywords: Erythrocytes, Heroin addiction, Smoking

INTRODUCTION

Smoking is an 'addiction' and not just a 'habit'.[1] Smoking is the single most important avoidable cause of premature morbidity and mortality in the world. It is a major public health problem in Pakistan.[2] It is hazardous to the health of those who are smoking themselves and to the people who are working in their surroundings.[3] Tobacco kills 274 Pakistanis everyday![4] Everyday 5,000 Pakistanis are admitted to hospital because of tobacco-related illnesses.[5] About 1,200 Pakistani children of 6–15 year age begin smoking every day[6], and 55% of Pakistani households have at least one smoker.[4] By 2030 more than 80% of the world's tobacco will be in low and middle income countries.[7] The harmful components of tobacco smoke are nicotine, tar and carbon monoxide.[8] Nicotine is a highly addictive drug, which, when inhaled, reaches the brain faster than injectable drugs including heroin.[9] Smoking is responsible for 90% of all causes of lung cancer and 10% of cancers of tongue, larynx, oral cavity, oesophagus, pancreas and urinary bladder.[10] Other common diseases caused by the use of tobacco include angina pectoris, sub-arachnoids haemorrhage, dental diseases, gastric ulcer, respiratory diseases and myocardial infarction.[11] Cigarette smoking affects haematological parameters including haemoglobin concentration, erythrocyte count, haematocrit value, MCV, MCH, MCHC, TLC, and DLC.[12] The present study was designed to compare the effects of cigarette smoking and heroin abuse on various haematological parameters especially the erythrocyte indices.

MATERIAL AND METHODS

The study was conducted on forty smokers and forty heroin addicts, and twenty controls. One hundred male smokers aged 26–35 years and having no apparent physical illness were included in the study. The subjects were divided into three groups, i.e., group A normal (control), group B cigarette smokers, and group C heroin addicts. Subjects having history of blood loss, blood transfusion and worm infestation were excluded on history, and laboratory investigation. Results were compared with twenty age and sex-matched normal controls who had never smoked or used heroin or any other substance of abuse.

Normal controls and smokers was chosen from the general population and heroin addicts were addicts living in streets and used to visit the 'Drop In' centres of Dost Foundation, Hayatabad, Peshawar. Smokers who were smoking at least 15–20 cigarettes per day for a minimum period of one year were included. Heroin addicts included in the study were abusing heroin for minimum period of one year and their urine thin layer chromatography was positive for morphine. Commercial chromatography strips (Acon Laboratory, United State) were used. After detailed medical history and clinical examination excluding any apparent physical illness, blood, urine and stools samples from consented subjects were obtained between 9 AM to 11 AM. Haemoglobin was estimated by photoelectric or spectrometric method. Haemoglobin concentration was calculated using the formula: Hb (gm/dl)= Absorbance of Sample/ Absorbance of Standard multiplied by

Concentration of standard multiplied by dilution factor (20:1) divided by 1,000. Erythrocyte count, Packed Cell Volume by micro-haematocrit method, MCV, MCH, and MCHC were calculated. Midstream urine samples were analysed for the required parameters. Data were analysed on SPSS-10.

RESULTS

Mean haemoglobin value of cigarette smokers was significantly higher compared to control subjects ($p<0.001$). Mean haemoglobin value of heroin addicts was found significantly lower when compared with either control group or cigarette smokers ($p<0.001$). The mean value of erythrocyte count was found high in cigarette smokers and lower in heroin addicts compared to normal subjects (Table-1).

Table-1: Mean haemoglobin and erythrocyte count of group A, B, and C

Group	Haemoglobin (gm/dl)		RBC count (million/mm³)	
	Range	Mean±SD	Range	Mean±SD
Control 'A'	14.0–14.8	14.28±0.274	4.3–4.9	14.28±0.274
Smokers 'B'	14.9–16.4	15.51±0.388	5.0–5.5	5.183±0.132
Heroin Addicts 'C'	8.0–13.7	11.69±1.477	2.8–4.3	3.755±0.431
A Vs B	$p< 0.001$		$p<0.001$	
A Vs C	$p< 0.001$		$p<0.001$	
B Vs C	$p< 0.001$		$p<0.001$	

The haemotocrit value (PCV) on the average was found to be raised in smokers and decreased in heroin addicts compared to control group. Average value of mean corpuscular volume (MCV) was significantly higher in smokers compared to normal individuals and heroin addicts ($p<0.001$). There was no significant differences in the mean value of MCV in heroin addicts compared to control subjects (Table-2).

Table-2: Mean value of PVC and MCV of group A, B, and C

Group	PCV		MCV (fl)	
	Range	Mean±SD	Range	Mean±SD
Control 'A'	40–44	41.2±1.28	86–93	88.35±1.84
Smokers 'B'	44–50	46.70±1.40	88–93	90.00±1.13
Heroin Addicts 'C'	25–39	33.25±3.87	83–92	88.45±2.42
A Vs B	$p<0.001$		$p<0.001$	
A Vs C	$p<0.001$		Not Significant	
B Vs C	$p<0.001$		$p<0.001$	

The average value of MCH was lower in smokers compared to heroin addicts and normal subjects. However, there were no significant differences in mean MCH of heroin addicts and control group. The mean corpuscular haemoglobin concentration (MCHC) was almost the same in heroin addicts and control group and decreased in smokers compared to controls or heroin addicts (Table-3).

Table-3: Mean values of MCH and MCHC of group A, B and C

Group	MCH (pg)		MCHC (gm/dl)	
	Range	Mean±SD	Range	Mean±SD
Control 'A'	30–35	30.80±1.28	33–35	34.5±0.61
Smokers 'B'	29–31	29.98±0.36	33–34	33.08±0.27
Heroin Addicts 'C'	28–33	31.05±1.22	32–37	35.00±1.30
A Vs B	$p<0.001$		$p<0.001$	
A Vs C	Not Significant		Not Significant	
B Vs C	$p<0.001$		$p<0.001$	

DISCUSSION

Tobacco is the single largest preventable cause of death. It is the only legally available consumer product that kills people when used. Tobacco epidemic killed 100 million people worldwide, in the 20th century.[13] Tobacco kills more than 5 million people each year worldwide.[14] One billion estimated deaths will occur during the 21st century worldwide because of tobacco use.[15]

Smoking affects various haematological parameters.[16,17] WHO Global Status Report–Pakistan-1997 estimates that there were more than 2 million drug addicts of all types in the country in 1991.[18] Global prevalence of opioid use in 2010 is estimated at 0.6–0.8% of the population aged 15–64 (26.4–36 million opioid users), of which nearly half use opiates, particularly heroin.[19] Heroin abuse has effects on the body including blood and its components.[20] Previous studies have shown an increase in haemoglobin concentration in cigarette smokers compared to non-smokers.[21] Results of our study are in agreement with previous workers showing a significant increase in haemoglobin concentration of cigarette smokers as compared to non-smokers. A significant increase in erythrocyte count and haemotocrit value (PCV) was observed in cigarette smokers compared with controls ($p<0.001$). Previous studies have also reported a rise in RBC count and PCV in cigarette smokers.[22] A possible mechanism of the increased erythrocyte count and PCV is that cigarette smokers have high carbon monoxide in blood compared to non-smokers, impairing oxygen transport.[23] The resulting hypoxia stimulates RBC production by releasing erythropoietin. This also indirectly leads to increased haemoglobin concentration.

Our study shows that haemoglobin concentration was significantly lower in heroin addicts compared to cigarette smokers and control subjects. This is in accordance with previous studies that report a decrease in haemoglobin concentration in heroin abusers.[24] A large population of heroin addicts is malnourished and has very poor personal hygiene.[25] Malnutrition being a cause of anaemia may be the reason for anaemia in heroin abusers because the addicts spend all what they have to get heroin even at the expense of their food! The addict population studied seems to be protected from autoimmune anaemia, which occurs in HIV infection in the West[26] because our

subjects were almost all using inhalation method and none used the intravenous route. The reason for high HIV infection in heroin addicts in the western countries is intravenous route of drug abuse and sharing syringes.

It was found that the anaemia is more severe in those subjects who were using a high quantity of heroin or were indulged in the habit for a longer duration probably because of the severity of malnutrition and lack of activity.

Our results show a significant decrease in erythrocyte count and PCV in heroin addicts compared to normal subjects. This is probably because of malnutrition, the heroin abusers are suffering from.

An increase in mean corpuscular volume (MCV) has been reported in cigarette smokers previously.[27] Our study also shows a significant increase in the MCV in cigarette smokers as compared to control group (*p*<0.001) or heroin addicts. There was no significant change in MCV in heroin addicts when compared with control subjects.

The mean corpuscular haemoglobin and mean corpuscular haemoglobin concentration were significantly lower in cigarette smokers compared to normal subjects or heroin addicts. The difference in MCH and MCHC of heroin addicts was not significant compared to control subjects. The decreased haemoglobin concentration and erythrocyte count and the normal MCH and MCV suggests a normochromic normocytic anaemia in heroin addicts which is in conformity with previous studies.[20]

CONCLUSION

Haemoglobin concentration, erythrocyte count and PCV are found higher in cigarette smokers and lower in heroin addicts compared to normal subjects. MCV is higher in cigarette smokers compared to control group. MCV in heroin addicts is not much different from that of normal subjects. MCH and MCHC are lower in cigarette smokers and higher in heroin addicts compared to control group. More research work is needed to study the mechanism of these haematological changes that occur in cigarette smokers and heroin addicts.

REFERENCES

1. Gilman SL, Xun Z. Introduction. In: Gilman SL, Xun Z (eds). Smoke: a global history of smoking. London: Reaktion Books; 2004.
2. Ahmed Z, Habib U, Kafeel M, Khan MH. Blood parameters and smoking pattern in Peshawar Colleges. Pak J Med Res 1995;34(3):190–3.
3. Robicsek F. Ritual smoking in Central America. In: Gilman SL, Xun Z (eds). Smoke: a global history of smoking. London: Reaktion Books; 2004.
4. Pakistan Health Education Survey 1991-1992. Islamabad: Ministry of Health, Government of Pakistan; 1993.pp.115–22.
5. Alam SE. Prevalence and pattern of smoking in Pakistan. J Pak Med Assoc 1998;48:64–6.
6. Jafarey NA. Tobacco (editorial) J Pak Med Assoc 1998;48(3):61.
7. Collin J, Gilmore A. Developing countries. In: Goodman J (ed), Tobacco in history and culture: an encyclopedia. Farmington Hills MI: Charles Scribner's Sons; 2004.
8. WHO. Chief Data Centre of WHO Monica Project. National Public Health Institute. Department of Epidemiology. Manver heimintie 166, SF-00280. Helsinki, Finland:1983.
9. Lopez AD, Collishaw NE, Piha T. A descriptive model of the cigarette epidemic in developed countries. Tob Control 1994;3:242–7.
10. Doll R, Petro R. Causes of cancer. Oxford: Oxford University Press; 1988.
11. Ilyas M, Naeem AJ. Tobacco and Health. In: Ilyas M (Ed). Community Medicine and public Health. 6th ed. Karachi: Time Publishers; 2013.pp. 1023–32.
12. Bridges RB, Wyatt RJ, Rehm SR. Effect of smoking on peripheral blood leukocytes and serum anti-proteases. Eur J Respir Dis Suppl 1985;139:24–33.
13. World Health Organization. World health report 2002: reducing risk, promoting healthy life. Geneva: WHO; 2002.
14. World Health Organization. Report on the Global Tobacco Epidemic. 2009.
15. World Health Organization. Report on the Global Tobacco Epidemic, 2008.
16. Noble RC, Penny BB. Comparison of leucocytes count and function in smoking anon smoking young men. Infect Immun 1975;12(3):550–5.
17. Rosello J, Olona M, Oltra C, Campins M, Vague J, Carrera A. Effects of smoking on hematological parameters in healthy people. Med Clin (Bare) 1990;94(10):368–71.
18. World Health Organization. Global Status Report–Paistan-1997: Tobacco Information and Prevention Source (TIPS), Centers for Disease Control. Available from: http://www.cdc.gov/tobacco/who/pakistan . [Accessed February 28, 2006.]
19. Global Effects of Tobacco Use. Available from: http://www.globalhealth.gov/ [Accessed February 28, 2006].
20. Zeb J, Tayyab M, Khan H, Qureshi SA, Sultan ML, Hussain SS. Basic hematological derangement in heroin addicts. Pak J Med Res 1995:34(3):194–5.
21. Whitehead TP, Robinson D, Allaway SL, Hale AC. The effects of cigarette smoking and alcohol consumption on blood haemoglobin, erythrocytes and leucocytes: a dose related study on male subjects. Clin Lab Haematol 1995;17(2):131–8.
22. Bury G, O'Kelly, Pomeroy L. The use of primary care services by drug users attending an HIV prevention unit. Irish Med J 1993;86:53–5.
23. Zelvin S, Saunders S, Gourlay SG, Jacob P, Benowitz NL. Cardiovascular effects of carbon monoxide and cigarette smoking. J Am Coll Cardinol 2001;38(6):1633–8.
24. Cameron AJ. Heroin Addicts in a Casualty Department. BMJ 1964;1(5383):594–8.
25. Qureshi SA, Tayyab M. Acquired Immuno-deficiency Syndrome as an autoimmune disease. Postgrad Med J 1990;1:101.
26. Helman N, Rubenstein LS. The effects of age, sex and smoking on erythrocytes and leucocytes, Am J Clin Pathol 1975;63(1):35–44.

Address for Correspondence:
Professor Dr. Muhammad Tariq, Department of Physiology, Kabir Medical College, Canal road, Academy Town, Peshawar, Pakistan. **Cell:** +92-333-9226345
Email: physiologist72@hotmail.com