

Astudy About Some Physiological Parameters In Smokers

L. H. A. Al-Azzawy , A. G. S. Al-Qaic

Department of Gommunity Health ,College of Health and Medical Technology, Foundation of Technical Education.

Received in:18 April 2010

Accepted in:14 December 2010

Abstract

Smoking has been accepted as a risk factor for many chronic diseases, including cardiovascular diseases, respiratory diseases, cancer, ulcers and osteoporosis. Tobacco smoke contains many oxidants and free radicals that can cause damage to lipids, proteins, DNA, carbohydrates and other biomolecules. *In vivo*, antioxidant nutrients which include vitamin C, selenium (Se), zinc (Zn) and copper (Cu) play a crucial role in defending against oxidant damage. The present study was designed to investigate the influence of cigarette smoking on serum Zn, Cu ,PCV,W.B.Cs., and BMI. Eighty healthy men (40 smokers and 40 non-smokers) from Baghdad, the capital of Iraq, volunteered to participate in this study. Two overnight fasting blood samples were collected from all volunteers. Serum concentrations of trace elements were measured by atomic absorption spectrophotometer. The statistical method of t-test and ANOVA was used to identify differences between the cigarette's smoker and non-smoker group. Mean body mass index (BMI) was different for the smoker and non-smoker group. Mean of PCV for smoker was significantly ($p<0.01$) higher than those of non-smokers. The mean count of W.B.Cs., was similar for both smokers and non-smokers. The serum zinc levels of smokers were significantly ($P<0.05$) lower than those of non-smokers. Smokers had significantly no difference in serum copper concentration compared with non-smokers.

Key words: Zn, Cu, Smokers, PCV, W.B.C.

Introduction

Cigarette smoking has been implicated as a significant risk factor for the establishment and progression of several diseases, including emphysema, chronic

bronchitis, cardiovascular diseases and cancer [1]. Tobacco smoke contains numerous compounds, many of which are oxidants and pro-oxidants capable of producing free radicals and enhancing the oxidative stress *in vivo*[2]. Each puff of a tobacco contains 10^{14} oxidants in the tar phase and 10^{15} in the gas phase[3]. The high production of these multiple types of oxidant and reactive oxygen species (ROS) associated with smoking may exceed the capacity of the oxidant defense system, resulting in oxidative damage to select proteins, lipids and DNA[4,5]. Consistent with a condition of

IBN AL- HAITHAM J. FOR PURE & APPL. SCI. VOL.24 (3) 2011

oxidative stress, concentrations of serum antioxidant vitamins, such as ascorbic acid and vitamin E, have been reported to be lower in chronic smokers than in non- smokers[6]. Also, several investigators have reported that zinc and selenium concentrations are typically reduced in adult smokers, whereas copper concentrations are typically increased [7-9]. Changes in Zn and Cu homeostasis in smokers have been postulated to contribute to some of the long-term negative effects associated with smoking and hypertension [8]. However, the available data are inconsistent regarding the effect of smoking on trace elements. Researchers demonstrated that one of the prominent risk factors for increased lipid peroxidation is smoking [10, 11] It has been reported that smoking is associated with elevations in plasma LDL- cholesterol and biologically modified lipoproteins such as oxidized low density lipoprotein (OXLDL), and decreases in plasma HDL- cholesterol levels[12]. Other indications suggest that smoking leads to elevated packed cell volume (PCV)[13,14]. Generally, there are conflicting results regarding the effect of cigarette smoking on trace elements and PCV; therefore, the three objectives of this study were to investigate the effect of smoking on some serum trace elements (Zn, and Cu); evaluate the effect of smoking on the PCV, W.B.Cs., and determine the influence of cigarette smoking on body mass index of healthy, adult Iraqi males

Materials and methods

Collection of blood and laboratory methods: The volunteers were asked not to smoke for more than 10 hours before sampling to exclude the effects of acute smoking on the blood parameters studied. All reagents were at least of analytical grade and supplied by Sigma-Aldrich chemicals (Sigma-Aldrich Ltd., Ont., Canada) unless indicated otherwise. All glasses or plastic wares used for tracing elements determination were cleaned by soaking overnight in 10% (v/v)hydrochloric acid, followed by thorough rinsing with de-ionized distilled water and drying. Aqueous solutions were made up in de-ionized distilled water.

Two blood samples were collected from all the volunteers. The first blood samples were centrifuged at 3000 g for ten minutes at room temperature and then serum was stored frozen until analyzed for the serum zinc, copper. The second blood samples were

used for PCV, and W.B.Cs. measurement. Hemolyzed samples were excluded from the analysis. Copper and zinc concentrations were determined by using an air/acetylene flame atomic absorption spectrophotometer. Copper, zinc, hollow cathode lamps (Thermo Electron, Cambridge, UK) were operated at 20mA for copper, at 15mA for zinc. Atomic absorption measurements were made at a wavelength of 324.8nm for copper, at 213.9nm for zinc. Stock atomic absorption standard

solutions of copper or zinc (Sigma chemical, St. Louis, USA) containing from 0.05 to 1 mg/ml were diluted with 10% (v/v) glycerol to obtain a standard curve for external calibration. A 10% (v/v) glycerol solution was used as a blank solution as instructed by the manufacturer. Serum samples were diluted (1:4) with 0.05% Triton-X 100 in 0.125% (v/v) nitric acid [15].

Method of Walker [16] using hematocrit centrifuge was performed to measure PCV, while method using hemocytometer (improved Neubauer chamber) was used to calculate W.B.C. [17]. Method of Romro et al., was used to calculate BMI [18]

IBN AL- HAITHAM J. FOR PURE & APPL. SCI. VOL.24 (3) 2011

Results

Data in table (1) have shown significant differences in mean concentration of Zn level between smokers and non-smoker (92 µg/dl, 105.5 µg/dl at $p < 0.05$) while no statistical significant differences were noted in mean concentration of Cu level of both smokers and non-smokers (167.5 µg/dl, 169.5 µg/dl at $p > 0.05$). Table (2) demonstrates highly significant differences in mean PCV among smokers and non-smokers (44%, 39% at $p < 0.01$) respectively, although there were no significant differences in mean count of W.B.Cs. for both smokers and non-smokers (6180 cell/mm³, 6230 cell/mm³ at $p > 0.05$).

Highly differences were found in BMI between smokers and non-smokers (20.273 kg/m², 23.66 kg/m² at $p < 0.01$). These results are shown in table (3).

Discussion

Some of the chemicals in cigarette's smoke generate a large number of free radicals, which may be related to the etiology of cancer and various diseases [19, 20]. Recent studies have demonstrated that antioxidants, including vitamin C and some trace elements such as selenium, zinc and copper, protect the body against reactive oxygen species (ROS) [21]. Furthermore, it has been reported that higher blood levels of antioxidants might be associated with a lower risk of cancer; however, until now there was a lack and conflicting results about the effect of cigarette smoking on serum trace elements, serum lipid profile, hypertension and body weight of the male Saudi population. Therefore, the present study is designed to evaluate the effect of cigarette smoking on body mass index,

serum trace element concentrations (zinc, and copper), PVC and W.B.C in healthy Iraqi men.

Smoking and trace elements: In our study, the lower serum zinc concentrations in the smokers are consistent with the results of Uz *et al.*[22] who found significant decreases in serum Zn levels of smokers compared with non-smokers and attributed the lower serum levels of Zn in smokers to deficient absorption of Zn caused by a tobacco chelation effect. In the other view cigarette smoking represents a source of substantial exposure to cadmium over a prolonged period. Each

stick of cigarette contains 1-2 ug of cadmium of which about 10% is absorbed by the lung. The very significantly decreased Zn level in smokers appears to confirm the known mutual antagonism between zinc and cadmium. Elsenhans[23] and Schümann[24] One possible explanation for this could be due to the established competition between Zn and Cd for binding sites on metallothionein. This suggests the strong possibility therefore, that increase in cadmium level diminishes zinc levels in smokers.

As the results indicated that even though dietary intake of minerals in smokers was adequate, the habitual diet is not able to maintain the plasma Zn concentration in the normal range, in the other hands, Zn is cofactor of antioxidant enzymes, therefore low level of Zn can result in health risk, because it plays a preventive role in degenerative disease [27]. However, Marcheggiani *et al.*[26] found no differences in Zn levels in smokers as compared to non-smokers. In the same respect, Kocyigit *et al.*[9] found that plasma zinc was statistically unaffected by smoking. Instead, as regards copper no differences were found in the two groups of smokers compared with the non-smokers. Our data confirms the results of Vargan *et al.*,[27], yet disagrees the results obtained by Khalid S.[28].

IBN AL-HAITHAM J. FOR PURE & APPL. SCI. VOL.24 (3) 2011

Cigarette smoking and PCV, W.B.C.: The Data in table (2) revealed a highly significant increase in mean of PCV for smokers compared with that for non-smokers at ($p < 0.01$). Our findings are generally in agreement with those previously reported [29,30]. Markman, however, reported a prompt fall in packed cell volume in smokers who were not allowed to smoke after their admission to hospital for various reasons [31]. He attributed this fall to the exposure to carbon monoxide (carbon monoxide reduces plasma volume) and changes of circulating catecholamine's induced by smoking. The same table has shown that there was no significant difference in mean count of W.B.Cs. for both smokers and non smokers.

Cigarette smoking and body mass index: In the present study high differences in body mass index were observed between smokers and non-smokers. The association between BMI and smoking is controversial in epidemiological research, since some authors have observed an inverse association [32, 33] unlike others showing no such association [34]

mean while, still other researchers have observed a positive association [35]. Our results are similar to the results of Kim *et al* [36], who found that the slightly lower body weight of smokers was probably secondary to a lower calorie intake in the smoking group compared to the non-smoking group. Kim *et al.* reported that cigarette smoking was not associated with a reduction in height. at $p < 0.05$.

Conclusion

The present study has revealed a depressed antioxidant nutritional status (i.e. serum zinc), and changing in other parameters like PCV and BMI. These effects may be due to the increase in the free radical load incurred by smoking which may initiate oxidative damage and the deterioration process.

References

1. Rahman, I. and MacNee, M. (1996). "Oxidant/antioxidant imbalance in smokers and chronic obstructive pulmonary disease". *Thorax* 51:348- 350.
2. Preston, A.M. 1991. Cigarette smoking nutritional implication. *Prog. Food Nutr. Sci.* 15:193-247.
3. Bluhm, A.L., Weinstein, J. and Sousa, A.J. (1971). "Free-radicals in tobacco smoke". *Nature* 229:500-507.
4. Cross, C.E., O'Neill, A.C. and Rezinick, Z.A. (1993). "Cigarette smoke oxidation of human plasma constituents". *Ann. NY. Acad. Sci.* 686:72- 89.
5. Yoshie, Y. and Ohshima, H. (1997). "Synergistic induction of DNA strand breakage by cigarette tar and nitric oxide". *Carcinogenesis* 18:1359- 1363.
6. Abou-Seif, M.A. (1996). "Blood antioxidant status and urine sulfate and thiocyanate levels in smokers". *J. Biochem. Toxicol.* 11:133-138.
7. Dubick, A.M. and Keen, C.L. (1991). "Influence of nicotine on tissue trace element concentrations and tissue antioxidant defense". *Biol. Trace Elem. Res.* 31:97-109.

IBN AL- HAITHAM J. FOR PURE & APPL. SCI. VOL.24 (3) 2011

8. Keen, C.L., Clegg, M.S. and Ferrell, F. (1987). "Hypertension induced alterations in copper and zinc metabolism: a link to vascular disease". In Sorenson, J.R. (ed.). *Biology of Copper Complexes*. Human Press, Clifton, NH, pp. 141-149.
9. Kocyigit, A., Erel, D. and Gur, S. (2001). "Effects of tobacco smoking on plasma selenium, zinc, copper and iron concentrations and related antioxidative enzyme activities". *Clinical Biochemistry* 34:629-633.
10. Nadiger, H.A., Mathew, C.A. and Sadasivudu, B. (1987). "Serum malondialdehyde (TBA reactive substance) levels in cigarette smoke". *Atherosclerosis* 64:71-73.

11. Nielsen, F., Mikkelsen, B.B., Nielsen, J.B., Andersen, H.R. and Granjean, P. (1997). "Plasma malondialdehyde as biomarker for oxidative stress: reference interval and effects of life-style factors". *Clin. Chem.* 43:1204-1214.
12. Craig, W.Y., Palomäki, G.E. and Haddow, J.E. (1989). "Cigarette smoking and serum lipid and lipoprotein concentrations: An analysis of published data". *Br. Med. J.* 298:784-788.
13. Terres, W., Becker, P. and Rosenberg, A. (1994). "Changes in cardiovascular risk profile during the cessation of smoking". *Am. J. Med.* 97:242-249.
14. Gibson, R.S. (1990). "Principles of Nutritional Assessment". 1st ed., Oxford University Press, Oxford, pp. 163-208.
15. Keilchiro, F., Pulido, R., McKay, B. and Vallee, L. (1964) "measurement of trace metals by atomic absorption spectrometry". *Anal. Chem.*, Vol.36, No.13, pp 2407-2411 .
16. Walker, H., Kenneth, H. and Dallas, H.W. (1990) "Clinical Methods, The history, physical and laboratory examination". *third edition, Butterworths publishers, Butterworths*, pp. 0-409.
17. Mitchell, S.L., Barbara, J.B. and Imelda, B. (1993) "Practical hematology" *tenth edition, Elsevier publisher*, pp. 0-450
18. http://en.wikipedia.org/wiki/Body_mass_index_-_cite_ref-12 Romero -Corral, Somers A., Sierra -Johnson V. K., Thomas J., Collazo-Clavell, R. J., Korinek, M. L., Allison, J., Bastsis T. G., Sert-Kuniyoshi, J. A., F. H. and Lopez-Jimenez, F. (2008) "Accuracy of body mass index in diagnosing obesity in the adult general population". *International Journal of Obesity*; (June 2008).. 32, No.6, pp. 959-956. [doi:10.1038/ijo.2008.182](https://doi.org/10.1038/ijo.2008.182)
<http://www.ncbi.nlm.nih.gov/pubmed/18283284>
19. International Agency for Research on Cancer (1986). "Tobacco smoking. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals and Humans", 38, Lyons, France.
20. Lee, B.M., Lee, S.K. and Kim, H.S. (1998). "Inhibition of oxidative DNA damage, 8-OHdG, and carbonyl contents in smokers treated with antioxidants (vitamin E, vitamin C, β-carotene and red ginseng)". *Cancer Letters* 132:219-227.
21. Stryker, W.S., Kaplan, L.A., Stein, E.A., Stampfer, M.J., Sober, A. and Willett, W.C. (1988). "The relation of diet, cigarette smoking and alcohol consumption to plasma beta-carotene and alpha-tocopherol levels". *Am. J. Epidemiol.* 127:283-296.
22. Uz, E., Semsettin, S., Ibrahim, F.H., Var, A., Sadik, S. and Omer, A. (2003). "The relationship between serum trace element changes and visual function in heavy smokers". *Acta ophthalmologica Scandinavia* 81:161- 164.
23. Elsenhans, B, Schümann, K. and Forth W. (1991) "Toxic metals: interacting with essential metals". In :Rowland, I.D.(ed). *Nutrition, Toxicity and Cancer*. CRC Press, Boca Raton, An Arbor, Boston, London, pp 223-258.
24. Schümann, K. (1993). "Interaction between iron and lead. In: *Metal- Metal Interactions*". Elsenhans, B, Forth, W. and Schümann, K. (eds). Bertelsmann Foundation Publishers, Gütersloh, Germany, pp 56-71.
25. Marcheggiani, F., Stella, F., Battistelli, S., Stocchi, O. and Troccoli, R. (1990). "Serum levels of Cd, Pb, Cu and Zn in cigarette smokers". *Boll. Soc. Ital. Biol. Sper.* 66:921-928.

27. Vargas, M. Eugenia, M. Ninfa, B., Alfonso, et al. (2007) "Influencia del habito de fumar sobre las concentraciones sericas de zinc, cobre y selenio en adultos jovenes" *AVFT, jun.*, 26, No.1, p 28. Khalid S. Al-Numair. (2006) "The influence of cigarette smoking on vitamin C, trace elements and lipid profile of healthy, Saudi adult males", *Journal of Food, Agriculture & Environment*, 4 (3&4) : 79-83

29. Dintenfass, L. (1975) "Elevation of blood viscosity aggregation of red cells, hematocrit values and fibrinogen levels in cigarette smoking" *Med. J. Aust.*, 1, pp.20-617 .

30. Galea, G. & Davidson, R.J. (1985) " Hematological and hemorheological changes associated with cigarette smoking " *Clin Pathol.* 38 ,No.9 pp.978-984.

31. Markman, P.F. (1981) " PCV on cessation of smoking" *JAMA.*, 45, pp.245-1314.

32. Pekkarian, H. G. Hanuinen, G. Tiau, H. Jin, R. (2002) "Comparison of dietary and non-dietary risk factors in over weight and normal weight Chinese adults". *Br J Nutr* , 88 ,pp.7-91.

33. Eck, L.H. Hackett-Renner, C. and Klesges, L.M. (1992) "Impact of diabetic status , dietary intake, physical activity , and smoking status on body mass index in NHANES II". *Am J Clin Nutr* , 56 , pp.33-329.

34. Colditz, G.A. Giovanuncia , E .Rimm, E.B. Stampfer, R. B. and Speizer, F.E. (1991) "Alcohol intake in related to diet and obesity in women and men" *Am J Clin Nutr* , 54 ,pp.49-55 .

35. Marti ,B., Tuomilehto, J., Korhonen, H.J. , Kartovaara, L. and Vartiainen, E. (1989) " Smoking and leanness: evidence for change in finland " *BMJ* , 90 ,pp.298- 1287.

36. Kim, S.H., Kim, J.S., Shin, H.S. and Keen, C.L. (2003). "Influence of smoking on markers of oxidative stress and serum mineral concentrations in teenage girls in Korea". *Nutrition* 19:240-243.

Tables

Table (1): Comparison among mean conc. Of Zn, Cu of both smokers and non-smokers.

P- value	Mean conc. of Cu** (µ/dl)	Mean conc. Of Zn* (µg/dl)	No. of participants	Samples
S* P<0.05	167.5	92	40	Smokers
N.S** P>0.05	169.5	105.5	40	Non-smokers
			80	Total

S*= Significant Difference

N.S**= Non-Significant Difference

Table (2): Comparison of mean Of PCV and mean count of W.B.C in smoker and non-smokers

P- value	Mean count of W.B.C** (cell/mm ³)	Mean of PCV* (%)	No. of participant	Sample
P<0.01 HS*	6180	44	40	Smokers

P>0.05 NS**	6230	39	40	Non-smokers
			80	Total

PCV: Packed Cell Volume

W.B.C : White Blood Cell.

HS*: Highly Significant

S*: Significant.

NS**.:Non-Significant.

IBN AL- HAITHAM J. FOR PURE & APPL. SCI. VOL.24 (3) 2011

Table (3) Mean of BMI of both smokers and non- smokers.

P- Value	Mean of BMI* (Kg/m ²)	No. of participate	Samples
H.S** P<0.01	20.273	40	Smokers
	23.66	40	Non-smokers

BMI*: Body Mass Index

H.S**.: Highly Significant

دراسة بعض المعايير الفسيولوجية في المدخنين

لمى حسين علي العزاوي ، احمد غازي صبار القيسي

. التقني التعليم هيئة , والطبية الصحية التقنيات كلية , المجتمع صحة قسم

2010 نيسان 18: في البحث استلم

2010 الاول كانون 14: في البحث قبل

الخلاصة

أجريت هذه الدراسة لتحديد بعض التغيرات الفسلجية للأشخاص المدخنين. شملت هذه الدراسة 40 شخصا "مدخنا و 40 شخصا "من غير المدخنين و كان معدل أعمارهم 22 سنة قيس مستوى الزنك والنحاس في مصل الدم باستعمال تقنية الامتصاص الذري. بينما حسبت كل من مجموع كريات الدم البيضاء وحجم الخلايا المرصوصة باستخدام الهيموسايتوميتر وجهاز الهيماتوكريت على التوالي, وحسب مقياس كتلة الجسم باستعمال معادلة خاصة بعد قياس الوزن والطول بشكل مضبوط.

كان مستوى الزنك والنحاس في مصل غير المدخنين (105.5 و 169.5 مايكروغرام اديسيليتر) على التوالي, بينما كانت نسبة الزنك, والنحاس في دم المدخنين (92 و 167.5) على التوالي . وحجم الخلايا المرصوصة ، ومجموع كريات الدم البيضاء لغير المدخنين كان (39 و 6230) على التوالي , وللمدخنين (44 و 6180) على التوالي . مقياس كتلة الجسم كان 23.66 لغير المدخنين و 20.273 للمدخنين

استعمل اختبار -ت واختبار تحليل المتغيرات في التحليل الإحصائي للنتائج .

الكلمات المفتاحية : زنك , نحاس , مدخنين , حجم الخلايا المرصوصة , مجموع كريات الدم البيضاء

