



A BIOCHEMICAL STUDY ON COAGULATION PROFILE, MALONDIALDEHYDE, MAGNESIUM, CALCIUM AND ZINC LEVELS AMONG SMOKERS AND NON SMOKERS.

Dr. E. Suresh

Associate Professor of Biochemistry, DR. PSIMS and RF, Andhra Pradesh.

Dr. V. Durga Prasad

Professor & Head, Department of Biochemistry, DR. PSIMS and RF, Andhra Pradesh.

Dr. Rashmi Jayswal

Assistant Professor, Department of Biochemistry, DR. PSIMS and RF, Andhra Pradesh.

ABSTRACT

Background: Smoking is one of the major causes for death of the patient around the world as it is major reason for the development of cancer, cardiovascular and other complications. **Aim and Objectives:** The study is mainly aimed to know the effect of coagulation profile, MDA, magnesium, calcium and zinc levels in smoker and a non smokers. **Materials and Methods:** It is a cross sectional study carried out in Biochemistry Department at Dr Pinnamaneni SIMS & RF, ChinnaAvutpalli for a period of 6 months. Our study includes 100 healthy individuals which includes 50 smokers and 50 non smokers of age between 20 to 50 years. We have excluded the patients on mineral supplementation, acute or chronic illness and other medications which can alter this parameters. All the parameters (coagulation profile, MDA, magnesium, calcium and zinc levels) were estimated in auto analyzer/ semi auto analyzer. **Results:** Smoking shows alteration in coagulation profile when compared to non smokers. Whereas MDA which is primary indicator of oxidative stress was significantly elevated. There is small variation of zinc levels in smokers. There is a mild reduction of serum calcium levels in a non smoker when compared to non smoker. Magnesium is having a negative correlation in smokers. **Conclusion:** Duration and number of cigars/day is significant predictor of low magnesium. It is the indicator of cardiovascular disease in young smokers. Decrease of zinc and increase of MDA shows more prevalent to oxidative stress.

KEYWORDS : MDA(Malondialdehyde), aPTT(activated partial thromboplastin time), calcium(Ca⁺)

INTRODUCTION

Smoking is one of the reasons for the many individuals all over the world. It involves all organs like Lungs, Heart, gastrointestinal tract and others. Its prevalence among the thirteen hundred million smokers in that 75% are in developing countries was estimated by WHO¹. Smoking is also becoming common among women². A systematic review by Jafari et al. found that 13% of adult females and 15% of adolescent females were smokers and also study have found that a high prevalence of smoking in pregnant women (21%)³.

More than 4,000 distinct compounds make up the complex concoction that is cigarette smoke.. Some of the compounds identified include pyridine alkaloids such as nicotine, ammonia, acrolein, phenols, acetaldehyde N-nitrosamine, polycyclic aromatic hydrocarbons such as benzopyrine, combustion gases such as carbon monoxide, nitrogen oxides, hydrogen cyanide, and trace metals, α -emitter radioactive elements such as polonium, radium and thorium etc⁴. Cigarette smoking generates reactive oxygen species like superoxide (O₂⁻), hydrogen peroxide (H₂O₂), hydroxyl (OH⁻) and peroxide (ROO) radicals which are capable of causing lipid peroxidation. Lipid peroxidation may initiate acute-phase reactions by elevating endothelial/monocyte interactions and release of cytokines such as IL-6, which are main route to inflammatory reactions⁵.

Zinc , magnesium, and calcium are important elements which plays as a cofactors for various enzymes, vitamins, hormones, and other processes which helps in maintaining health. Zinc will be fighting against the oxidative stress factors and protects the body from its effects but in smokers it causes negative effect which is due to reduction in antioxidant activity and elevation of oxidative stress.⁶

Magnesium is an important mineral which plays a role in the function of the central nervous system and on nicotine dependence. Nicotine dependence is due increased activity of the N-methyl-d-aspartate (NMDA) receptor which provokes the release of dopamine which is responsible for nicotine dependence⁸. Magnesium is potent inhibitor of NMDA receptors and it is mostly dependent on the levels of magnesium⁹.

Cigarette smoking causes derailment of coagulation profile by increasing the blood to coagulate that leads to obstruction of vessels which is called as thrombosis¹⁰.

We like to study these parameters as there is no such type of studies in this region to the best of my knowledge. The present study was

designed to study the effects of serum Zn, Mg, Ca, MDA levels along with coagulation profile with smoking along with its nicotine dependence.

MATERIALS AND METHODS

This is a cross sectional study carried at Dr Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation, Chinna Avutpalli Gannavaram Mandal. We have taken 100 age and sex matched individuals which include 50 smoking individuals and 50 non smokers between the age group 20 to 50 years. We have drawn 3ml of venous blood under aseptic conditions in a suitable vacutainer. We have analyzed for estimation of Serum Zinc, Magnesium, calcium, MDA and coagulation profile. They are analyzed in auto analyzer. All the results were expressed as mean $\pm$ SD. Results were tabulated statistically in prism graph pad new version. $p < 0.05$ was considered statistically significant. The study included the individual who are willing to give consent, smokers with no other illness. We have excluded from the study those who are not willing to give consent, alcoholics, and the individual is suffering from other illness. We have taken ethical clearance from institutional ethical clearance.

RESULTS

A group of 100 individuals in which we had taken both cases and controls. And also considered all the ethical issues, inclusion and exclusion criteria. The results were expressed in statistically

Table 1: Mean of serum MDA, Calcium, Zinc, Magnesium, PT and aPTT in Smokers and Non Smokers

PARAMETERS	CASES	CONTROLS	p VALUE
MDA	1.89 $\pm$ 0.36	1.34 $\pm$ 0.05	<0.0001*
Magnesium	1.09 $\pm$ 1.35	1.94 $\pm$ 0.13	<0.0001*
Calcium	8.88 $\pm$ 0.38	10.01 $\pm$ 0.67	<0.0001*
Zinc	72.64 $\pm$ 5.94	104.6 $\pm$ 9.92	<0.0001*
PT	11.14 $\pm$ 0.76	12.19 $\pm$ 0.98	<0.0001*
a PTT	26.74 $\pm$ 2.28	27.5 $\pm$ 4.22	0.2653

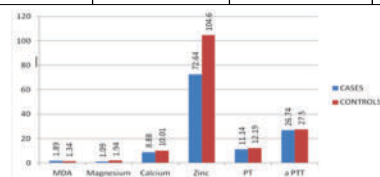


Figure 1: Mean of serum MDA, Magnesium, Calcium, Zinc, PT and aPTT

DISCUSSION

Smoking is a major leading cause for high mortality and morbidity in the world. In our study we had investigated serum MDA, magnesium, calcium, zinc, PT and aPTT.

In our study serum MDA showed that there is a statistically significant elevation in cases 1.89 ± 0.36 , controls 1.34 ± 0.05 and p value is <0.0001 . This is consistent with the study of Pasupati P, Yegneshwar Rao Y et al.⁴ and other studies. They showed that smoking releases many electrophilic compounds which reacts with biological macromolecules which gives rise to oxidative stress with the formation of reactive oxygen species which initiates lipid peroxidation. Peroxidation favors the susceptibility of serum triglycerides and smaller denser LDL particles. And also many studies showed that the nicotine leads to significant elevation of serum cholesterol, triglycerides and LDL-C and decrease of HDL-C in smokers than in non-smokers. Hence, there showed elevation level of MDA in chronic smokers compared to the non-smokers.⁵

In my present study serum magnesium, calcium and zinc showed there is statistically negative correlation with the smokers and statistically showed that magnesium 1.09 ± 1.35 in cases, 1.94 ± 0.13 controls, Calcium 8.88 ± 0.38 cases, 10.01 ± 0.67 controls and zinc showed 72.64 ± 5.94 cases, 104.6 ± 9.92 controls and showing p value is <0.0001 . All these parameters are coinciding with the Karunakaran B, Shankar, et.al where it has been said the smoking depends on its severity and its duration of smoking. It is considered as early risk marker for cardiovascular disease. In other studies, it is shown that severity of smoking is contributing factor affecting the level of serum magnesium and it has an inverse relationship with hypertension and coronary heart diseases¹². Mohammed AM, et.al⁶ in his study showed that zinc levels are decreased in a smoker and this study is correlating with our present study. And also it was shown by other author Pepic E .et.al.¹³ Due to deficient absorption of zinc and magnesium in a tobacco taking individual increases cadmium levels with significant excretion of zinc. Another parameter serum calcium 8.88 ± 0.38 cases, 10.01 ± 0.67 controls and p value is <0.0001 is statistically lowered in a smoker when compared to smokers. My study is correlating with the study of Salah Eldin Omar Hussein et. Al.¹⁴ showed that serum calcium and phosphate, the most likely cause is inhibition of the action of parathyroid hormone on the renal tubules and therefore lowering of serum calcium and increasing of serum phosphate.

My study about PT and aPTT showed that there is a significant alteration statistically in PT 11.14 ± 0.76 cases, 12.19 ± 0.98 controls and p value is <0.0001 rather than aPTT 26.74 ± 2.28 cases, 27.5 ± 4.22 controls and p value is 0.2653 in smokers. Elkhalfa¹⁵ in their study found that aPTT had no significant variation in smokers and non-smokers and my study is correlating with the above study. Sivagangailakshmi and Rajkumar¹⁶, showed that there is a significant alteration in PT and it is correlating with my study.

CONCLUSION

This study reveals significant alterations in smokers when compared to non smokers. Smoking has been shown to adversely affect coagulation, leading to potential risks of increased clotting and thrombotic events. Smokers tend to exhibit higher MDA levels, indicating increased oxidative stress and cellular damage, which can contribute to cardiovascular and other chronic diseases. Additionally, smokers demonstrate imbalances in essential minerals like magnesium, calcium, and zinc. These imbalances could be linked to the pro-inflammatory and pro-oxidative effects of smoking, further exacerbating health risks. Overall, smoking leads to a disruption in vital biochemical pathways, emphasizing the importance of smoking cessation for improving and maintaining good health.

REFERENCES

1. Anshika Srivastava, Kshama Tiwari, Sumaiya Irfan et al.: Cigarette smoking and its effect on coagulation profile, hematological parameters, and oxygen saturation in healthy blood donor Asian Journal of Medical Sciences | Aug 2024 | Vol 15 | Issue 8 140-150
2. M. Ng, M. K. Freeman, T. D. Fleming, M. Robinson, L. Dwyer-Lindgren, and B. omson, "Smoking prevalence and cigarette consumption in 187 countries, 1980–2012," *Journal of the American Medical Association*, vol. 311, no. 2, pp. 183–192, 2014.
3. A. Jafari, A. Rajabi, M. Gholian-Aval, N. Peyman, M. Mahdizadeh, and H. Tehrani, "National, regional, and global prevalence of cigarette smoking among women/females in the general population: a systematic review and metaanalysis," *Environmental Health and Preventive Medicine*, vol. 26, no. 1, p. 5, 2021.
4. Pasupathi P, Saravanan G, Farook J. Oxidative Stress Bio Markers And Antioxidant Status In Cigarette Smokers Compared To Nonsmokers. *Journal of Pharmaceutical Sciences and Research* 2009; 1(2): 16-21.
5. Sangappa Virupaxappa Kashinakunti, Pampareddy Kollur, Gurupadappa Shantappa

- Kallaganada et.al, 'Comparative study of serum MDA and vitamin C levels in non-smokers, chronic smokers and chronic smokers with acute myocardial infarction in men' *J Res Med Sci* 2011; 16(8): 993-998
6. Mohammed AM, Hashish AF, El-Saeed GS. Studying the association between cigarette smoking and serum copper, zinc, and magnesium concentrations: A cross-sectional study. *J Public Health Prim Care* 2023;4:42-7.
7. Nechifor M. Magnesium and zinc involvement in tobacco addiction. *J Addict Res Ther* 2012;S2:005.
8. Poleszak E, Szewczyk B, Kedzierska E, Wlaż P, Pilc A, Nowak G. Antidepressant- and anxiolytic-like activity of magnesium in mice. *Pharmacol Biochem Behav* 2004;78:7-12.
9. Polidori MC, Mecocci P, Stahl W, Sies H. Cigarette smoking cessation increases plasma levels of several antioxidant micronutrients and improves resistance towards oxidative challenge. *Br J Nutr* 2003;90:147-50.
10. Soronnadi CN, Ugwene FO, Odurukwe O, Odetunde OI and Nweke LM. The impact of chronic smoking on the intrinsic and extrinsic coagulation pathways of smokers in Enugu, South-East Nigeria. *Br J Med Med Res*. 2015;12(9):1-5.
11. Karunakaran B, Shankar P, Thomas T. Study of effect of duration and severity of smoking on serum magnesium levels in young smokers. *J. Evid. Based Med. Healthc*. 2019; 6(27), 1858-1862.
12. Peacock JM, Folsom AR, Arnett DK, et al. Relationship of serum and dietary magnesium to incident hypertension: the Atherosclerosis Risk in Communities (ARIC) Study. *Ann Epidemiol* 1999;9(3):159-165
13. Pepić E, Šečić D, Lepara O, Kapić-Pleho A, Kurtagić-Pepić E, Mušanović J, et al. Smoking effect on the cadmium and zinc concentration in smokers and nonsmokers. *Bull Chem Technol Bosn Herzegovina* 2022;57:17-26.
14. Salah Eldin Omar Hussein: "Effect of Cigarettes Smoking on the Serum Levels of Calcium and Phosphate in Sudanese Males in Khartoum" *International Journal of Research in Pharmacy and Biosciences* Volume 2, Issue 8, September 2015, PP 4-9
15. Elkhalfa AM. Effects of cigarette smoking on coagulation screening tests and platelet counts in a Sudanese male adults population. *Saudi Med J*. 2018;39(9):897-901.
16. Sivagangailakshmi V and Rajkumar D. Effects of cigarette smoking on coagulation profile among smokers. *Int Arch Integr Med*. 2017;4(8):116-120.