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Effect of Cigarette Smoking on Trace Elements among Residents in Khartoum State, Sudan

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Objective: This research were conducted to determine the direct effects of cigarette smoking on some minerals (Mg^{2+}, Fe^{2+} & Zn^{2+}) and to bridge the gap of information.

Material and Methods: Study design is a Prospective, laboratory-based analytical study, which was used to measure Mg^{2+}, Fe^{2+} & Zn^{2+} in cigarette smokers in the period from March to June 2019. This study was conducted in Khartoum state at Bahry and Alkalakla localities.

Keywords: *cigarette smoking, magnesium, iron, zinc, Sudanese.*

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Effect of Cigarette Smoking on Trace Elements among Residents in Khartoum State, Sudan

Sara Khalafalla Abdalgader [α], Salman Taha Ahmed Elmukashfi [σ], Abubakr Hassan Khougali [ρ], & Rashid Eltayeb Abdalla [ω]

Abstract- Background: Hundreds of thousands around the world die from a disease caused by smoking cigarettes. A number of researches indicated that smoking has numerous immediate health effects on the respiratory, cardiovascular, gastrointestinal, immune, and metabolic systems. Lung cancer, other cancer, heart disease, and stroke typically do not occur until years after Persons first cigarette. Epidemiological studies have consistently shown an association between the toxin in the cigarette and coronary heart disease (CHD). Cigarette smoking had a dangerous effect on the essential biochemical mechanisms on the human body.

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Results: The study showed that there was significant decrease in the serum levels of magnesium (mean =15.0 mg/dl) when compared with normal range [17-27 mg/dl]. Also there was significant increase of serum iron (mean=3.1mg/dl) compared with normal range (0.5-1.5mg/dl), and significant decrease in serum level of zinc (mean 0.4mg/dl) compared with normal range (0.5-1.2mg/dl).

The study revealed that age of the smokers, duration of the smoking, marital status, economic, their education, and that the number of cigarettes smoked per day do not affect the serum level of magnesium, iron, and zinc, but in marital status the zinc level which has significance difference.

Conclusion: The study concluded that the serum level of magnesium, iron, and zinc was affected by smoking, the serum level of magnesium and zinc are decrease, and iron increased in smoking. The age, duration, number of cigarettes, social status, economic status, job, and education of smokers do not affect the serum level of magnesium, iron, and zinc.

Keywords: *cigarette smoking, magnesium, iron, zinc, Sudanese.*

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I. Introduction

Smoking is a practice in which a substance, most commonly tobacco or cannabis smoke, tasted or inhaled. The most common method of smoking today is through tobacco Use Leads Most Commonly to diseases affecting the heart and lungs, with smoking being a risk factor for heart attacks, strokes, chronic obstructive pulmonary disease (COPD), Emphysema, and cancer. It also causes peripheral vascular disease and hypertension. All developed due to the exposure time and the level of dosage of tobacco [1, 2]. Minerals are essential substances involved as catalysts in most cellular enzymatic reactions and assume a role in metabolism [3].

Fe^{2+}, Zn^{2+}, and Mg^{2+} are examples of these essential minerals. Functions of Fe^{2+} include involvement in energy metabolism, gene regulation, cell growth, and differentiation [4, 5], etc. Mg^{2+} is a critical cation and cofactor in numerous intracellular processes. It is involved in more than 300 essential metabolic reactions, some of which are: energy production, synthesis of essential molecules, structural roles, ion transport across cell membranes, cell signaling, and cell migration [6].

Zn^{2+} is second only to iron in importance as an essential trace element. The biochemical role of Zn^{2+} is its influence on the activity of more than 300 enzymes. Zn^{2+} can be essential for the structure, regulation, and catalytic action of an enzyme. Zn^{2+} occurs in enzymes that realize the synthesis and metabolism of DNA and RNA. Zn^{2+} influences the synthesis and metabolism of proteins, participates in glycolysis and cholesterol metabolism, maintains membrane structures, effects functions of insulin, and affects growth factor [7, 8].

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Literature survey showed that no sufficient work had been conducted to study the effect of cigarette smoking on serum minerals alterations, so this study were carried out to determine the influence of cigarette smoking on serum Fe^{2+}, Zn^{2+}, and Mg^{2+} levels among Sudanese smokers and to determine the relationship between the levels of serum Fe^{2+}, Zn^{2+}, and Mg^{2+} with age, a number of cigarettes per day, and duration of smoking cigarette smoking causes minerals disturbances which lead to serious consequences, smoking leads to tissue hypoxia which leads to inadequate oxygenation of blood circulation that results in erythropoiesis [9, 10] which enhances erythropoiesis and increases red cell mass above normal level [11], this leads to an increase in the number of destroyed red cells in the normal turnover process, which subsequently increases iron overload, which causes hepatocellular damage. Chronic oxidative stress may modulate iron uptake and storage, leading to a self-sustained and ever-increasing spiral of cytotoxic and mutagenic events [12, 13]. Smoking causes Mg^{2+} deficiency due to decreased supply (lesser appetite) and reduced absorption caused by disturbances in the digestive system functions [14]. Nicotine-addicts usually have the risk of depletion/deficiency in nutrients and minerals, including zinc [15]. Minerals disturbances may lead to life-threatening metabolic abnormalities such as coronary heart disease, liver disease, lung infection, kidney failure, and disorders of endocrine system [16].

II. Material and Methods

The study design is a Prospective, laboratory-based analytical study, which was used to measure Mg^{2+}, Fe^{2+} & Zn^{2+} in cigarette smokers in the period from March to June 2019. This study was conducted in Khartoum state at Bahry and Alkalakla localities. They included 30 Blood samples was collected from cigarette smokers, the restriction of the sample size to 30 subjects is due to lack of financial support. Data was collected using a questionnaire. After disinfected by using alcohol, about (2.5ml) of venous blood were collected from each volunteer by venipuncture technique, and were placed in anticoagulant containers, and then centrifuged at (3000 rpm) for (5 minutes) to obtain plasma which kept in Eppendorf tubes for measurements of Fe^{2+}, Zn^{2+}, and Mg^{2+}. And the plasma levels of magnesium, iron, and zinc were determined by the use of the atomic absorption spectrophotometer (OPERATOR'S MANUAL January 2003 VER 3.94 C), and the results was analyzed by SPSS.

a) Ethical Consideration

Permission to carry out the study were taken from health administration, Shendi University committee, and the smokers was informed before the collection of samples, and verbal consent was take.

b) Data Collection

Data were collected using a structural interviewing questionnaire. Which was designed to collect and maintain all valuable information concerned each case examined.

c) Sampling Collection

The forearm was disinfected by using alcohol, about (2.5ml) of venous blood were collected from each volunteer by venipuncture technique, and were placed in anticoagulant containers, and then centrifuged at (3000 rpm) for (5 minutes) to obtain plasma which kept in Eppendorf tubes for measurements of Fe^{2+}, Zn^{2+}, and Mg^{2+}.

d) Quality Control

The precision and accuracy of all methods used in this study were checked at each batch.

e) Data analysis

The data were analyzed by using the application of SPSS (statistical package for social sciences), version 21.

III. Results

The direct effect of cigarette smoking on Mg^{2+} /Fe^{2+} and Zn^{2+} concentration among the Sudanese population In Khartoum State. The result of Fe^{2+} denoted high concentration with mean (3.1mg/L) compared with normal range (0.5-1.5mg/L). But the result of Mg^{2+} indicated mean (15 mg/L), which was low concentration compared with normal range (17-28mg/L), also the result of Zn^{2+} showed low concentration with a mean (0.4 mg/L) compared with normal range 0.5-1.2mg/L.

Table 1: Mean and Std. Deviation of Fe^{2+}, Mg^{2+}, and Zn^{2+}

	Fe^{2+}	Mg^{2+}	Zn^{2+}
Mean	3.1mg/L	15.0mg/L	0.4mg/L
Std. Deviation	0.8	1.7	0.1

Table (1) revealed that high Mg^{2+} and low Fe^{2+} & Zn^{2} levels.

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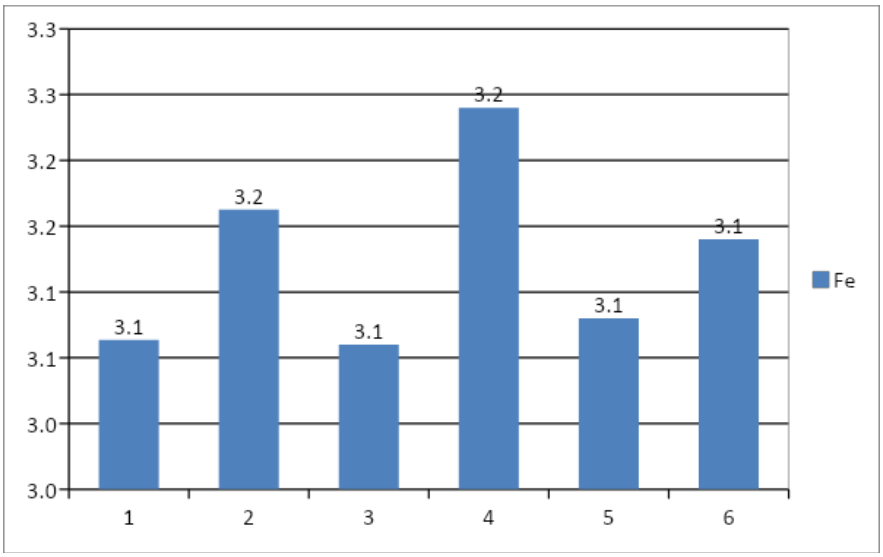


Figure 1: Mean of Fe^{2+}, with age (p-value =0.70), duration (p-value= 0.60) and number of cigarette (p-value =0.80), revealed insignificance difference in compare with normal p-value (0.05)

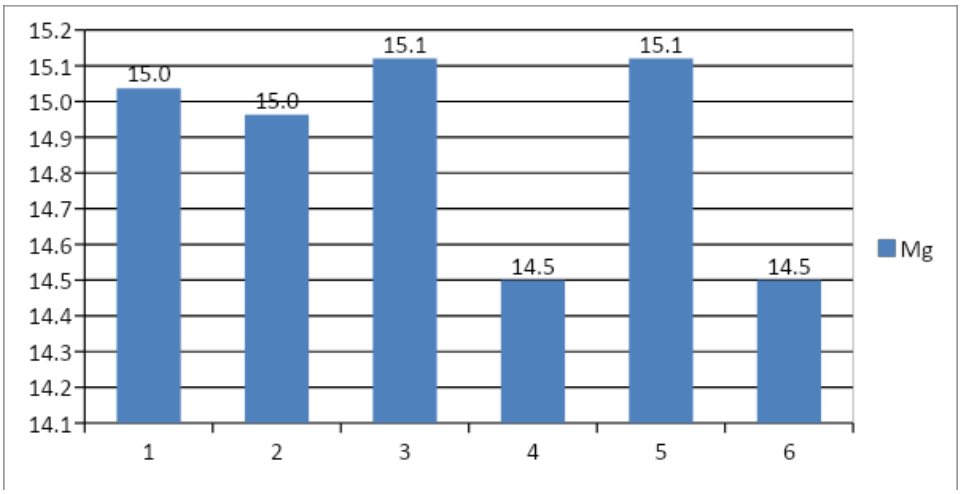


Figure 2: Mean of Mg^{2+} with age (p-value=0.90), duration (p-value=0.40) and number of cigarette (p-value=0.40), revealed insignificance difference in compare with normal p-value (0.05)

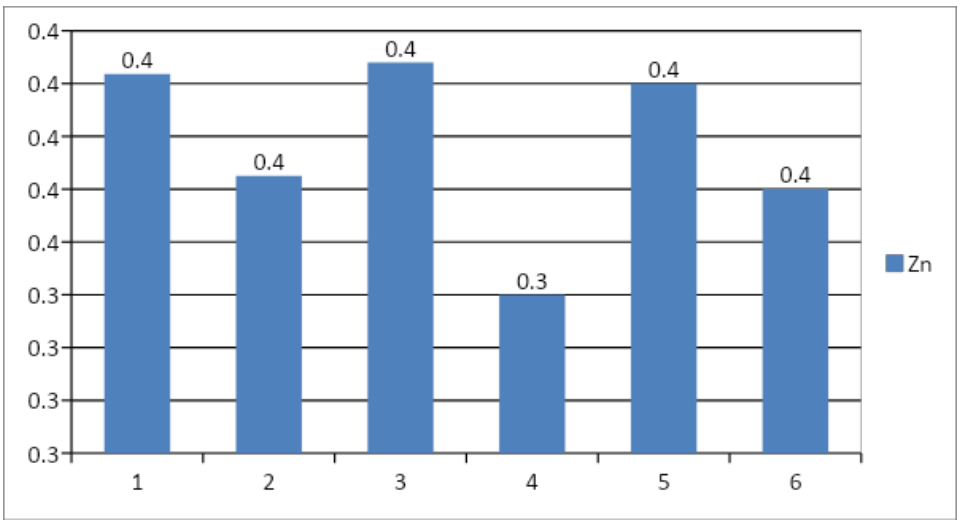


Figure 3: Mean of Zn^{2+} with age (p-value= 0.60), duration (p-value =0.30) and number of cigarette (p-value =0.60), revealed insignificance difference in compare with normal p-value (0.05)

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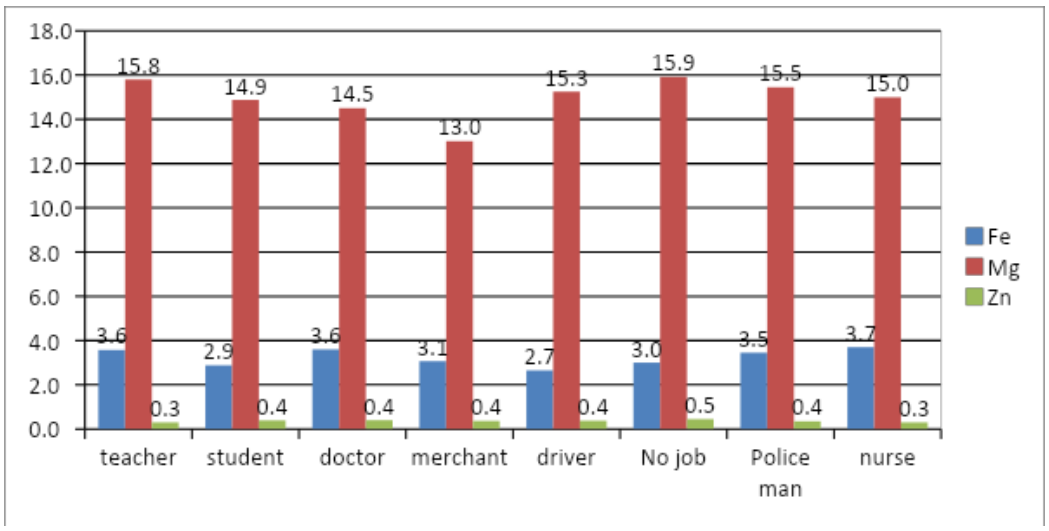


Figure 4: Mean of Fe^{2+} (p-value =0.40), Mg^{2+} (p-value= 0.50), Zn^{2+} (p-value= 0.80) with job, revealed insignificance difference in compare with normal p-value (0.05)

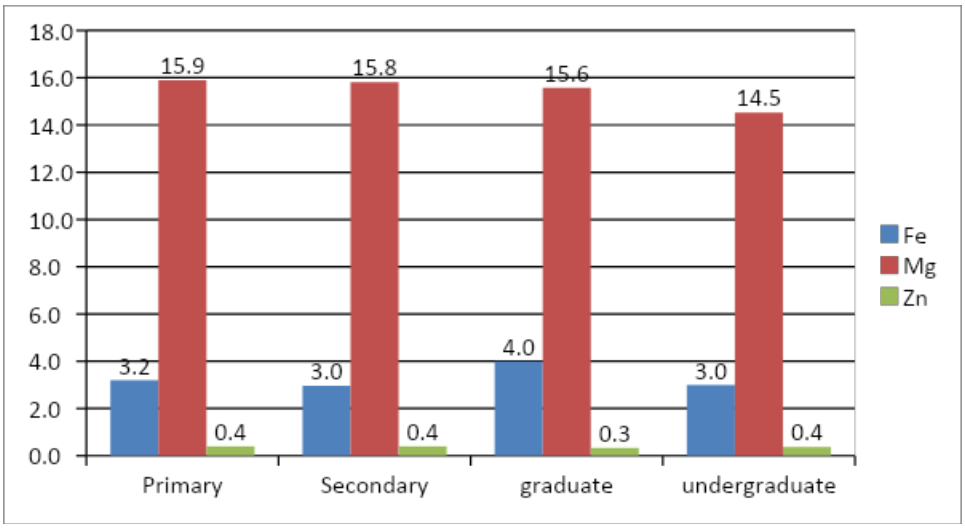


Figure 5: Mean of Fe^{2+} (p-value=0.70). Mg^{2+} (p-value=0.50), and Zn^{2+} (p-value =0.30) with education revealed insignificance difference in compare with normal p-value (0.05)

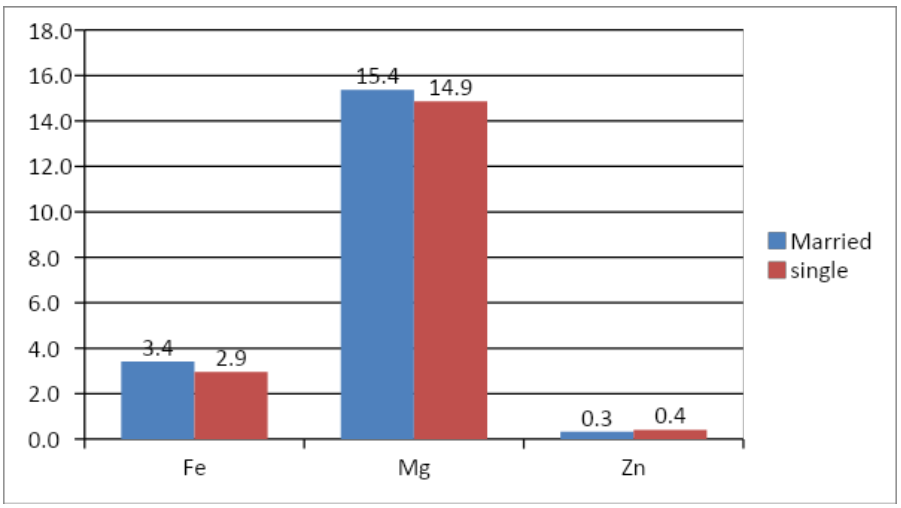


Figure 6: Mean of Fe^{2+}, (p-value= 0.10) Mg^{2+} (p-value=0.40) with marital status revealed insignificant difference. Zn^{2+}show significance difference (p-value=0.02).in compare with normal p-value (0.05)

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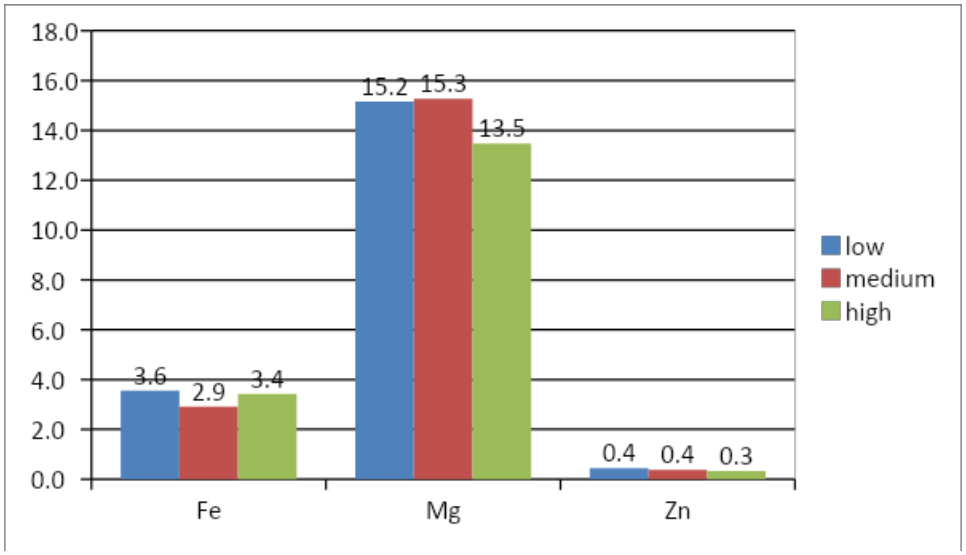


Figure 7: Mean of Fe^{2+}, (p-value=0.50), Mg^{2+} (p-value =0.40) & Zn^{2+} (p-value=0.20) with economic status, revealed insignificant difference in compare with normal p-value (0.05)

IV. Discussion

The present study were carried out to investigate the trace element (magnesium, iron, and zinc) among Sudanese people of cigarette smokers in Bahry and Alkalakla cities/ in Khartoum state in Sudan during the period from March to June 2018; 30 blood samples was collected from Sudanese male smokers.

The present study showed that a high concentration of Fe^{2+} with a mean (3.1mg/dl) compared with the normal range (0.5-1.5mg/dl). The serum level of Mg^{2+} is low mean (15 mg/L), when compared with the normal range (17-28mg/L), and also resulted of Zn^{2+} showed low concentration with a mean (0.4 mg/L) compared with the normal range 0.5-1.2mg/L, this agreed with (Sulafa Ali and Samia Mahdi et al. 2013) who was reported statistically significant changes in the serum levels of Mg^{2+} and Fe^{2+} between test and control group, the level of Mg^{2+} was high and was Fe^{2+} low in smokers compared to nonsmokers.

The findings of this study also prevailed a non-significant difference between the serum levels of Mg^{2+}, Fe^{2+}, and Zn^{2+} of the test group according to the duration (P-value = 0.4/0.6/0.3), and to the age (P-value = 0.9/0.7/0.6) respectively. The number of cigarettes smoked per day have no effect on the level of serum Mg^{2+}, Fe^{2+} and Zn^{2+} (P-value =0.4/0.8/0.6), this agreed with (Sulafa Ali and Samia Mahdi et al. 2013) who was reported that there was statistically no significant influence of age, duration and number of cigarette per day on Mg^{2+}, Fe^{2+} levels, when compared with serum Mg^{2+}, Fe^{2+} with age, duration, and number of cigarette per day with a study group.

The results of the recent study presented the non-significant difference between the serum levels of, Mg^{2+}, Fe^{2+} and Zn^{2+} of the test group according to the job (P-value =0.5/0.4/0.8) respectively, and non-significance difference to the education (P 0.5/0.7/0.3) subsequently, also to social status (p 0.4/0.1) in which Zn^{2+} has a significant difference with (p 0.02) and showed a non-significant difference between the serum level of Mg^{2+}, Fe^{2+}, and Zn^{2+} according to economic status (p 0.4/0.5/0.2) respectively.

V. Conclusion

From this study can be concluded that the serum level of magnesium iron and zinc was affected by smoking, the serum level of magnesium and zinc are decrease, and iron increased in smoking. The age, duration, number of cigarettes, social status, economic status, job, and education of smokers do not affect the serum level of magnesium, iron, and zinc.

References Références Referencias

1. West, R. and Shiffman, S., (2016). Fast facts: smoking cessation. Karger Medical and Scientific Publishers.
2. Zampieri, F.G., Kellum, J.A., Park, M., Ranzani, O.T., Barbeiro, H.V., de Souza, H.P., da Cruz Neto, L.M. and da Silva, F.P., (2014). Relationship between acid–base status and inflammation in the critically ill. Critical Care, 18(4), p.R154.
3. Beard, J.L., (2001). Iron biology in immune function, muscle metabolism and neuronal functioning. The Journal of nutrition, 131(2), pp.568S-580S.
4. Serefko, A., Szopa, A. and Poleszak, E., (2016). Magnesium and depression. Magnesium research, 29(3), pp.112-119.
5. Lv, Y., Liu, C., Wei, T., Zhang, J.F., Liu, X.M. and Zhang, X.F., (2015). Cigarette smoking increases risk of early morbidity after hepatic resection in patients with hepatocellular carcinoma. European

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Journal of Surgical Oncology (EJSO), 41(4), pp.513-519.
6. Emerit, J., Beaumont, C. and Trivin, F., (2001). Iron metabolism, free radicals, and oxidative injury. Biomedicine & pharmacotherapy, 55(6), pp.333-339.
7. Unkiewicz-Winiarczyk, A., Bagniuk, A., Gromysz-Kałkowska, K. and Szubartowska, E., (2009). Calcium, magnesium, iron, zinc and copper concentration in the hair of tobacco smokers. Biological trace element research, 128(2), pp.152-160.
8. Al-Azzawy, L.H.A., (2017). The Impact of Cigarette Smoking on Levels of Sex Hormones and Zinc in Blood of Smokers. Ibn AL-Haitham Journal for Pure and Applied Science, 24(2).
9. Centers for Disease Control and Prevention (CDC, (2002). Annual smoking-attributable mortality, years of potential life lost, and economic costs--United States, 1995-1999. MMWR. Morbidity and mortality weekly report, 51(14), p.300.
10. Centers for Disease Control and Prevention CDC, (2005). Annual smoking-attributable mortality, years of potential life lost, and productivity losses--United States, 1997-2001. MMWR. Morbidity and mortality weekly report, 54(25), p.625.
11. Mohmmed, S.K.A., (2018). Effect of Cigarette Smoking on Trace Elements (Magnesium, Zinc & Iron) of some resedents in Khartoum State, Sudan (Doctoral dissertation, Rashid Eltayeb Abdalla).
12. Carter, E.B., Temming, L.A., Akin, J., Fowler, S., Macones, G.A., Colditz, G.A. and Tuuli, M.G., (2016). Group prenatal care compared with traditional prenatal care: a systematic review and meta-analysis. Obstetrics and gynecology, 128(3), p.551.
13. Saltos, A., Smith, D., Schreiber, K., Lichenstein, S. and Lichenstein, R., (2015). Cell-phone related injuries in the United States from 2000–2012. Journal of safety studies, 1(1), pp.1-14.
14. Koch, M., Kohnle, M., Trapp, R., Haastert, B., Rump, L.C. and Aker, S., (2012). Comparable outcome of acute unplanned peritoneal dialysis and haemodialysis. Nephrology Dialysis Transplantation, 27(1), pp.375-380.
15. Rossi, E., (2005). Hepcidin-the iron regulatory hormone. Clinical Biochemist Reviews, 26(3), p.47.
16. Mohmmed, S.K.A., (2018). Effect of Cigarette Smoking on Trace Elements (Magnesium, Zinc & Iron) of some resedents in Khartoum State, Sudan (Doctoral dissertation, Rashid Eltayeb Abdalla).

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