**Bull. Egypt. Soc. Physiol. Sci. 13 (1) 1993**

**STUDY Of SERUM TRACE ELEMENTS IN SMOKERS:**

**RELATION TO URINARY COTININE**

**BY**

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**Abstract**

**Twenty one healthy non-smoking males and nineteen healthy smoking males, matched for age and body weight, were investigated to outline the effect of cigarette smoking on the serum levels of iron (Fe), Copper (Cu), Zinc (Zn) and selenium (Se). As a marker for cigarette smoking, urinary cotinine was chosen and assessed for its simplicity and reliability. Smokers showed significantly decreased mean serum iron (P<0.02) and significantly increased mean urinary cotinine (P<0.001) levels as compared to non-smokers. However, there were no significant differences between the mean levels of serum Zu, Cu and Se in both groups. The low serum iron level in smokers could be explained by the impairment of iron uptake, absorption, mobilization and/or utilization due to both nicotine effect and hypovitaminosis C prevailing among smokers.**

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**Introduction**

**There is no strict definition for a smoker, although it is generally agreed that a heavy smoker is someone who smokes at least 15 cigarettes dailyW. Smoking of tobacco has been spread throughout the world, despite vigorous official opposition and, in some cases, draconian penalties. Tobacco smoking affects almost all tissues of the body. It is through catecholamine release, stimulated by nicotine, that tobacco smoking exerts definite effects on vital systems as cardiovascular and nervous systems(l).**

**Nicotine assessment has the advantage of being specific, but requires extensive laboratory equipment. Recently, urinary cotinine, the main metabolite of nicotine, proved to be a simple and reliable marker of inokingt3'1). Investigations including trace elements in smokers are few and the results are controversial. The aim of the present study is to investigate the serum concentrations of Fe, Cu, Zn and Se and**

**to correlate them to urinary cotinine ti**

**n**

**Subjects and Methods**

**The study was carried out on 40 healthy adult male volunteers. They were classified according to their own words concerning cigarette smoking into 2 groups:**

**Group 1 included 21 non smokers.**

**Group 2 included 19 smokers.**

**The duration of smoking ranged from 2 to 10 years with the number of cigarettes smoked per day varying from 5 to 40 cigaettes. Both groups were nearly of the same socio-economic class and were matched for age,and body weight.**

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**To exclude the presence of any organic disease, the following parameters were performed:**

1. **Detailed history taking.**
2. **complete physical examination with calculation of the body mass index (B.M.I.)**
3. **Determination of the serum levels of alanine transaminase**

**(ALT)(5), albumin(b,7), Creatinine(s) and fructosamine(9,10) to**

**exclude acute and chronic liver diseases, kidney diseases**

**and diabetes mellitus respectively.**

**Also the following specific tests were performed for each subject:**

1. **Serum trace elements estimation: (iron, copper, zinc and seleminum) using a Perkin Elmer spectrophotometer model**

**2380(11).**

1. **Determination of urinary cotinine contentU2) and urinary creatinine(l) levels. Both necessitated 24-hour urine collection, with consequent calculation of cotinine/ creatinine rratio.**

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**Results**

**Results are shown in tables 1 and 2.**

**Table (1): Clinical data, serum ALT activity, albumin, creatinine and fructosamine levels in non-smokers and smokers.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Non smokers** | | | **Smokers** | | | **P** |
|  |  |  |  |  |  |
|  | **Mean** | **SDt** | **SE±** | **Mean** | **SDt** | **SE±** |  |
| **1.Body ass index** | **24.836** | **2.726** | **0.595** | **24.614** | **2.535** | **0.582** | **>0.3** |
| **(kg/m')** |  |  |  |  |  |  |  |
| **2.Ar. T (U/ml.)** | **19.381** | **8.738** | **1.907** | **17.737** | **11.599** | **2.661** | **>0.3** |
| **3.Albumin (g/dl)** | **4.171** | **0.761** | **0.166** | **4.221** | **0.554** | **0.127** | **>0.4** |
| **4.Creatinine.** | **0.686** | **0.182** | **0.040** | **0.758** | **0.135** | **0.031** | **>0.08** |
| **(mg/dl)** | **2.148** | **0.224** | **0.489** | **2.045** | **0.301** | **0.075** | **>0.1** |
| **5.Fructosamine.** |  |  |  |  |  |  |  |
| **(m.Mol./L)** |  |  |  |  |  |  |  |

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**Table (2): Urinary cotinine and serum levels of trace elements (Be, Cu, *Zn* and Fe) in non-sackers and smoker ,.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Non smokers** | | | **Smokers** | | | **P** |
|  |  |  |  |  |  |
|  | **an** | **Sot** | **SEt** | **Mean** | **SDt** | **SEt** |  |
| **1.Urinaxy cotinine** | **81.695** | **56.037** | **12.530** | **2307.2** | **1305.6** | **307.74** | **<0.001'** |
| **(ug/mq creatinine)** |  |  |  |  |  |  |  |
| **2.Serum selenium** | **7.267** | **0.747** | **0.163** | **7.416** | **0.822** | **0.189** | **>0.2** |
| **(4g/dl)** |  |  |  |  |  |  |  |
| **3.Serum coVper** | **99.048** | **10.543** | **2.301** | **97.895** | **13.245** | **3.039** | **>0.3** |
| **(sg/dl)** |  |  |  |  |  |  |  |
| **4.Serum zinc (µg/dl)** | **69.238** | **7.576** | **1.653** | **70.789** | **8.709** | **0.275** | **>0.2,** |
| **5.Serum iron (Ng/dl)** | **91.905** | **18.888** | **4.122** | **78.632** | **22.716** | **5.211** | **<0.02** |

**\* - Significant**

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**Discussion**

**Urinary cotinine is believed to be a better marker of smoking than the parent alkaloid nicotine, since cotinine is endogenously produced only through the oxidative metabolism of**

**nicotine in the body(13, meanwhile it is found in trace amounts outside the body in tobacco leaves or tobacco smoke("). This makes contamination of samples with exogenous cotinine, in contrast to nicotine, very unlikelyUS). Also cotinine can be more easily identified since the concentrations are higher in both blood and urine because of the much higher plasma half-life and more protracted urinary excretion rate("). In the present study, urinary cotinine level was significantly increased in smokers as compared to non-smokers. A similar finding was reported by both Jarvis et al.t17 and Tawadrous et**

**The small amount of cotinine detected in the urine of non-smokers most probably resulted from the so called passive smoking.**

**As regards selenium, there was no significant difference in the mean serum level between both groups. This finding is in agreement with the reports of Chow et al.,(") and Saaranen at al. , (19j.Swanson et al. , «0) reported that smokers had lower serum selenium concentrations than did non-smokers, due, at least in part, to lower selenium intake. They concluded that selenium intake was clearly the strongest predictor of tissue selenium concentration. However, it is extremely difficult to measure individual selenium intake because of the highly variable selenium composition of the different samples of the**

**same food(2 . Low serum selenium levels are associated with an increasing risk of development of cancer at several sites**

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**especially cancer of the stomach and the lung among manit2). Based on this fact and the findings of Swanson et al.,, it**

**has been suggested that fortification of tobacco with selenium**

**has an antimutagenic effect.**

**The present study did not show significant differences in the mean serum levels of both Cu and Zn between the 2 groups. Schwartz and Weiss,23) also reported no significant interactions between smoking and certain nutrients namely vitamin C, sodium, potassium, zinc and copper. Uza and Vlaciu (24) found that serum zinc level was not significantly different in smokers compared to non-smokers, but serum copper was reported to be increased in heavy smokers with atherosclerosis and they related this increase to tobacco smoking. Davidoff et al.,«S) previously reported similar unexplainable elevation of serum copper and ceruloplasmin in heavy smokers. Bhardway et a1.,(26) attributed this increase to the chronic pulmonary disease state present in smokers with tissue destruction and necrosis**

**followed by release of copper from the damaged tissues.**

**Serum iron was significantly decreased in smokers compared to non-smokers. This could be attributed to diminished dietary intake or disturbed iron absorption. Nicotine was reported to inhibit iron uptake but has a little effect on the steady state levels of transferrin, probably by acting as a weak base inhibiting its release from transferrin and inhibiting exacytosis27). Another factor which could contribute to the low serum iron in smokers is the insufficiency of vitamin C reported to be prevalent among smokers121 Vitamin C is required for absorption and**

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**Thus, in conclusion , cigarette smoking has adverse effects on iron metabolism , manifested by low serum iron levels , a finding that could be attributed to impaired uptake, absorption, moblization and for utilization.**

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