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Research Article

Levels of Cobalt and Chromium in Cigarette Smokers, Khartoum State

Nasreen Ibrahim Ahmed[1], Gad Allah Modwawe[2], Abd Elkarim A. Abdrabo[1*]
[1] Department of clinical chemistry, Faculty of medical laboratory Sciences, Alneelain University-Khartoum-Sudan
[*]Corresponding author: Head-Department of Clinical chemistry, Faculty of Medical Laboratory Sciences, Al-Neelain university-Khartoum-Sudan
[2]Omdurman Islamic University, Faculty of Medicine ,Biochemestry Department, Omdurman, Sudan

***Corresponding author**
AbdElkarim A. Abdrabo
Email: abdrabokarim@hotmail.com

Abstract: Metals in tobacco smoke are of public health concern because of their potential toxicity and carcinogenicity. This is a case-control study carried out in Khartoum State from November to March 2015. Three ml of venous blood were collected from study population; serum cobalt and chromium were estimated using absorption spectrophotometer. The study results revealed that the mean age of smokers was (26.4±4.1) year and for non smokers was (25.7±3.0) year. The mean ± SD of serum cobalt and chromium in smokers respectively were (0.79±.23 and 0.09±.0) µg/L. The mean ±SD of serum cobalt and chromium in non-smokers were (.09±.05 and.2 ±.10)µg/L respectively. There was a highly significant difference in serum chromium between smokers and non-smokers (p value 0.000, <0.05).The mean of serum chromium was significantly lower 8.8 fold in non-smokers compared to smoker's group. Serum cobalt was significantly lower 3.5 times in no-smokers compared to smokers group. There was positive correlation between serum cobalt and smoking duration (r= -0.471, p=0.001).There was a significant relationship between smokers duration of smoking and no. of cigarettes per day and the serum cobalt level (p< 0.05).Duration of smoking is useful as apredictor of smokers for serum cobalt. This study concluded that; levels of serum chromium and serum cobalt are increased in cigarette smokers. The increased in level of serum cobalt affected by the duration of smoking, but not affected by number of cigarettes and the difference in age.
Keywords: Cigarette smoker's serum chromium, serum cobalt, Khartoum state

INTRODUCTION

The significant numbers of people continue to smoke in the developing countries [1]. In Sudan, prevalence of cigarette smoking in the adult population reached 12% [2] . Alternatively in the some developed countries, although prevalence of cigarette smoking is almost double that of Sudan, it started to decrease over the last year[3]. Cigarette smoking is a known risk factor for respiratory[4], cardiovascular[5], neoplastic[6] and other diseases[7]. The common pathophysiologies of most smoking related diseases are imbalance of systemic oxidants and antioxidants[8], enhanced inflammatory reactions[9], insulin resistance[10], dyslipidemia[11] and others[12].

Environmental exposures to chemical, physical, and biological agents may cause or contribute to disease in susceptible individuals; however personal lifestyle factors, such as diet, smoking, alcohol use, level of exercise, and UV exposure, often are a primary focus when considering preventable causes of disease[13]. However, exposures to chemical contaminants on the job, at home, in the outdoors, and even in utero, are increasingly recognized as important and preventable contributors to human disease[14]. Some trace element such as chromium and Cobalt elevation was observed high in smoker as compared to non smoker [15]. However Chromium defines as the mineral that humans require in trace amount while its mechanism of action in the body and the amount needed for optimal health are not well defined[16]. Chromium is known to enhance the action of insulin [17], however Chromium deficiency impairs the body's ability to use glucose to meet its energy needs and raises insulin require men. Therefore it has been suggested that chromium supplements might help to control type 2 diabetes or the glucose and insulin responses in person at high risk of developing of the disease[18].

The current study aimed to measure chromium and cobalt level in male smokers compared to non-male smokers.

MATERIAL AND METHODS

A case control study was conduct in Khartoum state during the period of December 2014 –March 2015. Hundred male volunteers were recruitedfor this study.

Of those fifty volunteers were cigarette smokers (age ranging between 18-45) years and fifty were non smokers (age ranging between 18-45)years, as control group).

Both groups were without history of alcohol consumption, chronic diseases, and snuffer user .Volunteers was enrolled in the study after being fully informed about the aims of the study. In addition, written consents had been obtained. The history included information about the volunteers obtained from them according to the designed study questionnaire.

Under a septic condition, about 3ml of venous blood were collected from each volunteer by vein puncture technique and were placed in anticoagulant free containers, and allowed to clot then centrifuged at 3000 rpm for 5 minutes to obtain serum which kept in eppendorf tubes for measurements of Chromium and Cobalt. Serum Chromium and Cobalt were measured by using Atomic Absorption Spectrophotometer.

Statistical Analysis

Statistical evaluation was performed using the Microsoft Office Excel (Microsoft Office Excel for windows; 2007) and SPSS (SPSS for windows version 19). Inferential statistics was used such asstudent's t-tests, correlation and regression coefficient.

RESULTS

Table -1: Mean (Mean± SD) of age, serum chromium and cobalt in smokers and non smokers

Variable	Study group		Significance test
	Smokers (Patients)	Non-smokers (Control)	*P.value*
Age (years)	26.4±4.1	25.7±3.0	0.46
Chromium (M ± SDµg/L)	.79±.23	.09±.05	0.000*
Cobalt (M ± SDµg/L)	.7±.15	.2 ±.10	0.000*

**P-value significant at 0.05 level*

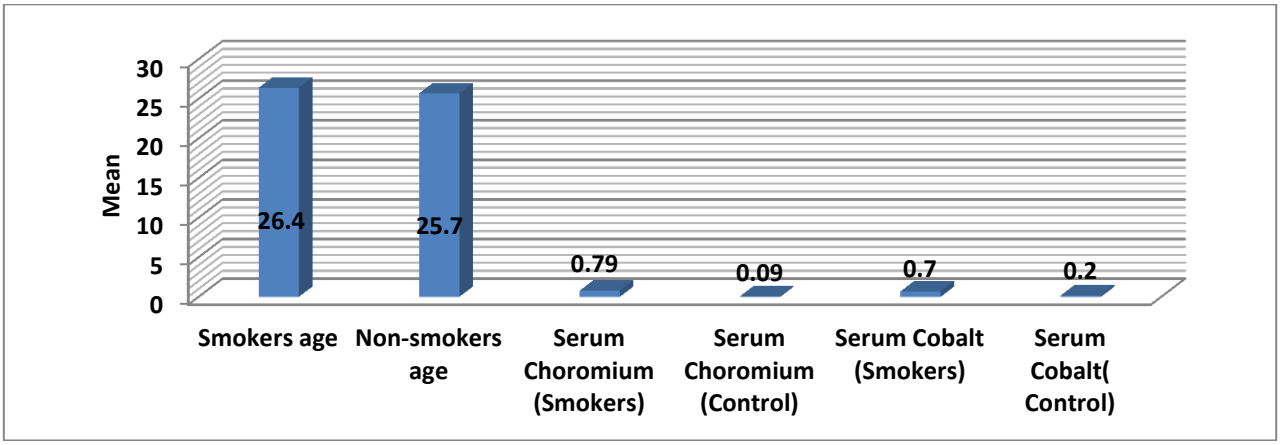

Fig-1: Mean of age, serum chromium and cobalt in smokers and non smokers

Table -2: Correlation between age, no. of cigarette per day, duration of smoking, serum chromium and serum cobalt

		Age	No of cigarette day	Duration of Smoking	S.cobalt
Age	Pearson Correlation	1	.021	.471**	.168
	Sig. (2-tailed)		.883	.001	.244
No of cigarette per day	Pearson Correlation	.021	1	.285*	.249
	Sig. (2-tailed)	.883		.045	.081
Duration of Smoking	Pearson Correlation	.471**	.285*	1	.335*
	Sig. (2-tailed)	.001	.045		.017
S.cobalt	Pearson Correlation	.168	.249	.335*	1
	Sig. (2-tailed)	.244	.081	.017	
S.chromium	Pearson Correlation	-.157-	.085	.145	-.108-
	Sig. (2-tailed)	.276	.555	.314	.455

***. Correlation is significant at the 0.01 level (2-tailed)., *. Correlation is significant at the 0.05 level (2-tailed).,*

Tobacco smoke is a complex, dynamic and reactive mixture containing an estimated 5,000 chemicals[19]. This toxic and carcinogenic mixture is probably the most significant source of toxic chemical exposure and chemically mediated disease in humans[20]. According to WHO estimates, 5.4 million premature deaths are attributable to tobacco smoking worldwide[21]. If current trends continue, 10 million smokers per year are anticipated to die by 2025[22]).

In This study indicated thatthe mean age of smokers was (26.4±4.1) year and for non smokers was (25.7±3.0) year. The mean of years was relatively similar; this may be caused due to the requirements of case control study and the subjects were very young. The finding disagreed with Jeneiet al, 2000 who found that Smokers were younger, with a mean age of 43.4 yearvs 47.1 year for non-smokers (P<0.01) [23].

The mean serum cobalt was significantly lower 3.5 times in no-smokers compared to smokers group. The result in line with study conducted by Alexandersson 1988 who stated that the non-occupationally exposed smokers had higher cobalt concentrations than non-smokers[24]. Other studies disagreed with our study stated that Smoking had no effect on Cobalt human serum albumin[25]. In a cross-sectional study among 194 diamond polishers working with Cobalt containing disks and 59 controls who worked with disks without Cobalt, three dosegroups were formed. The Cobalt exposure of the controls varied was varied. The mean Cobalt exposure in the high exposure group was greater compared to low exposure group[26].

Also the study revealed that themean of serum chromium was significantly lower 8.8 fold in non-smokers compared to smokers group. The finding supported by several studies mentioned that the level of chromium in mainstream cigarette smoke ranges from 0.0002 – 0.5 mg per cigarette[27]. In above work it is found that concentration of Chromium is higher in biological samples of smokers, while in non-smokers concentration is low in all biological samples. It was also seen that with the increase in age the concentration of metal also increased. Our this outcome supported[28], in which concentrations of about 4.3 mg/kg (dry weight) are found in smokers compared to 1.3 mg/kg in non-smokers, it ncreased with age and smoking time.

My own study reported that there is a significant relationship between duration of smokers and the serum cobalt level. Also the study indicated thatduration of smoking is useful as apredictor of smokers for serum cobalt. The finding supported by many studies showed that duration of smoking is the strongest determinant of excess lung cancer risk in smokers[29]. However the majority of lung cancer cases have smoked for decades. Also in the original British study and in the study by Wynder and Graham, 43–50% of lung cancer cases had smoked ≥40 years. Another study done by Doll and Peto, 2005 showed that lung cancer risk in smokers is higher in those who start smoking at a younger age[29].

CONCLUSION

From this study, a strong relationship was found between smokers and these metals, when samples of smokers and nonsmokers were compared. Significant difference was found in case of each metal. Levels of chromium and cobalt trace elements were elevated in smokers compared to non-smokers.

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