Assessment of Homocysteine (Hcy) levels among Sudanese male smokers, Khartoum, Sudan

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Abstract

Background: Smoking may cause atherosclerosis and acute cardiovascular events. Hyperhomocystenemia may be found in smokers and it plays a vital role in development of atherosclerosis and acute cardiovascular events. The aim of this study is to investigate the effects of smoking on the plasma homocysteine concentration.

Methods and Materials: A case control study conducted in the period from March to August 2017. Homocysteine was measured in 150 subjects: 50 non-smokers and 100 smokers using spectrophotometric methods.

Results: Among 150 subjects, the mean age of smoker group was 37.4 ± 9.3 years and 36.2 ± 10.4 years in non-smokers. The mean serum homocysteine level was 16.5 ± 3.1 µmol/L in smoker group and 6.8 ± 2.7 µmol/L in non-smoker group. The difference was statistically significant which mean that homocysteine was 12.4 ± 3.5 in the smoking duration of 1 – 5 years, 14.8 ± 2.4 in the duration of 6 – 10 years and 17.2 ± 3.2 in the smoking duration of more than 10 years. Homocysteine level was 13.8 ± 4.3 in the rate of less than 10 cigarettes per day, 16.5 ± 3.3 in the rate of 10 to 20 cigarettes per day and 19.7 ± 2.8 in the smoking rate of 21 to 30 cigarettes per day, the difference was statistically significant.

Conclusion: This study concluded that high levels of Homocysteine were found in smokers when compared to non-smokers individuals. The duration and rate of smoking strongly correlated with the levels of Homocysteine in smoking individuals.

Keywords: Homocysteine, non-smokers, smokers

Introduction

Homocysteine is a non-protein α-amino acid. It is a homologue of the amino acid cysteine, differing by an additional methylene bridge (-CH$_2$-). It is biosynthesized from methionine by the removal of its terminal C$^{\varepsilon}$ methyl group. Homocysteine can be recycled into methionine or converted into cysteine with the aid of certain B-vitamins [1].

A high level of Homocysteine in the blood (hyperhomocysteinemia) makes a person more prone to endothelial cell injury, which leads to inflammation in the blood vessels, which in turn may lead to atherogenesis, which can result in ischemic injury [2]. Hyperhomocysteinemia is therefore a possible risk factor for coronary artery disease. Coronary artery disease occurs when an atherosclerotic plaque blocks blood flow to the coronary arteries, which supply the heart with oxygenated blood [3].

Hyperhomocysteinemia has been correlated with the occurrence of blood clots, heart attacks and strokes, though it is unclear whether hyperhomocysteinemia is an independent risk factor for these conditions. Hyperhomoscyteinemia has also been associated with early pregnancy loss and with neural tube defects [4,5].

Smoking is a practice in which a substance is burned and the resulting smoke breathed into be tasted and absorbed into the bloodstream. Most commonly the substance is the dried leaves of the tobacco plant which have been rolled into a small square of rice paper to create a small, round cylinder called a "cigarette". Smoking generally has

negative health effects, because smoke inhalation inherently poses challenges to various physiologic processes   such   as respiration.   Diseases   related   to tobacco smoking have been shown to kill approximately half of long-term smokers when compared to average mortality rates faced by non-smokers. Smoking caused over five million deaths a year from 1990 to 2015 [6]. Smoking is one of the most common forms of recreational drug use. Tobacco smoking is the most popular form, being practiced by over one billion people globally, of   whom the majority are in the developing world [7].This study aims to assess the levels of homocysteine in smokers in Khartoum, Sudan.

Justification

The World Health Organization (WHO) attributes approximately 20.3% of smoking products that is used in Sudan, and nearly five million deaths a year due to smokingc. There are multiple researches about clinical correlation between homocysteine and smoking, but the majority of researches are conducted in Europe and USA. According to our knowledge there are no published data in Sudan on this topic.

Methods and Materials

Study design

This research is a case control study conducted in Khartoum, Sudan between the period March 2017 and July 2017. In this case study 150 subjects were enrolled. the patient's group consisted of 100 smokers, and the control group included 50 subjects as non-smokers. Additionally, the study excluded individuals with hypertensive diabetes, history of heart disease, and thrombosis.

From the case and control group 3ml of venous blood was drawn by sterile syringe and then added to a container containing anticoagulant of heparin. During the collection,   great care was taken throught the study to avoid sexual transmitted diseases and dermatitis of different origins. The collected samples were stored in ice boxes in the lab. Later, the samples were centrifuged to obtain the plasma.

Homocysteine concentrations were assayed in plasma samples spectrophometerically by using Hcy Biosystem® Kit. Homocysteine concentrations above 15 μmoles/L were considered high, as classified by Kang *et al.* (1992) [8].

Data analysis

SPSS (Statistical Package for Social Science program) version 21 was used for data analysis. In addition Independent T-test and ANOVA were used as the tests of significance. And P. value was considered as significant at level 0.05.

Results

This study included 100 smokers (case group) and 50 non-smoker (control group) individuals. The mean age of smoker group was 37.4±9.3 years and non-smoker was 36.2±10.4 years. Among the smokers, the mean of smoking duration was 6.9 ± 2.9 years and the rate of smoking was 16.5±6.2 cigarettes per day (Table1).

Table (1): Shows the age, duration and rate of the smoking among the study group (n= 150)

	Smoker	Non-smoker	P. value
Age (Years)	37.4±9.3	36.2±10.4	0.462
Duration of the smoking (years)	6.9 ± 2.9	-	
Rate of the smoking (cigarettes/ day)	16.5±6.2	-	
Independent t-Test was used			

The mean serum homocysteine level was 16.5±3.1 μmol/L in smoker group and 6.8±2.7 μmol/L in non-smoker group. And the difference was statistically significant (P= 0.000) (Table 2).

Table (2):Shows the Homocystiene levels among the study groups (n= 150)

	Smoker	Non-smoker	P. value
Homocystiene (µmol/L)	16.5±3.1	6.8±2.7	**0.000***
Independent t-Test was used *P. value is significant at 0.05 level			

In the distribution of homocysteine levels (regarding the duration of the smoking) the mean of homocysteine was 12.4±3.5 in the duration of 1 – 5 years, 14.8±2.4 in the duration of 6 – 10 years and 17.2±3.2 in the smoking duration of more than 10 years. The difference was statistically significant (P= 0.037) (Table 3)

Table (3): Shows the levels of homocysteine levels regarding the duration of the smoking

Duration of Smoking (years)	Hcy levels		P. value
	Mean	**SD**	
1 – 5 years	12.4	3.5	
6 – 10 years	14.8	2.4	0.037
>10 years	17.2	3.2	

According to the distribution of homocysteine levels regarding the rate of smoking, the mean of homocysteine was 13.8±4.3 in the rate of less than 10 cigarettes/ day, 16.5±3.3 in the rate of 10 – 20 cigarettes/ day and 19.7±2.8 in the smoking rate of 21 – 30 cigarettes/ day, and the difference was statistically significant (P= 0.024) (Table 4).

Table (4): Shows the levels of Homocysteine levels regarding the rate of smoking

Rate of Smoking (cigarettes/ day)	Hcy levels		P. value
	Mean	**SD**	
<10	13.8	4.3	0.024
10 – 20	16.5	3.3	
21 – 30	19.7	2.8	

Discussion

In the present study, the mea n serum homocysteine level was higher in smoker than in nonsmokers. Smoking increases Homocysteine (Hcy) level. High levels of Homocysteine may increase the risk of certain diseases including CVD, strokes, cancers, diabetes, depression and Alzheimer'sdisease. Some researchers state that 1 mol/L increase in serum Hcy concentration is associated with a 10% increase in CHD risk and it becomes 42% with every five unit increase in serum Hcy concentration [9,10]. A high level of serum homocysteine makes a person more prone to endothelial injury, which leads to vascular inflammation, atherogenesis and ischemic injury. It has been correlated with the occurrence of blood clots, which causes occlusion of arteries and leads to ischemic heart diseases, heart attacks and strokes [11]. Similar findings were reported by Özerol E. *et al*.(2004) (16.2±2.01 µmol / l vs. 8.0±1.65 µmol / l)[12], and Sabitha P. (2013) (18.3 ± 8.8 vs. 12.4 ± 6.7 µmoles/L[13]. Also, P. O'Callaghan *et al.* (2002) found that smokers had significantly high Homocystiene levels when compare with non-smokers. Cigarette smokers with a plasma homocysteine above 12 µmol / l1 had a 12-fold increased risk of cardiovascular disease (OR 12·4 95% CI 7·3 to 21·2) compared with non-smokers with a normal plasma homocysteine [14].

Furthermore, our study revealed that the Homocysteine levels significantly increased during the duration of the smoking, while the highest mean (17.2±3.2) was found in the smoking duration of more than 10 years. This finding consist with what was found by Dhouha H. *et al* (2011). It found that the longer duration and the higher rate of smoking were strongly associated with high levels of plasma homocysteine [15].

Conclusively, our study demonstrated that, Homocysteine levels were significantly increased with the rate of the smoking, and the highest level of homocysteine was encountered in the smoking rate of 21 – 30 cigarettes/ day (19.7±2.8). P. O'Callaghan *et al.* (2002) Additionally, reported in their study that Homocysteine levels were significantly positive strong correlated with the rate and the frequencies of number of cigarette [14].

Conclusion

This study concluded that a high Homocysteine level was found in smokers when compared to non-smokers. Furthermore, the age, duration and rate of smoking strongly correlated with levels of Homocysteine in smoker individuals. Homocysteine levels should be detected routinely for smokers to avoid the risk of cardiovascular diseases.

Acknowledgments

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