Environmental pollution adverse effects of smoking habits in smokers using cigarette and water pipe smokers volunteer / Basrah, Iraq

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Abstract

Smoking is considered one of the worldwide society habit which causes economic, social, and health negative effects which inducing by toxic chemicals that pollute the internal and external environment of smokers and their ambient. Recently, our society have showed a highly use of water pipe smoking, which is used the tobacco as raw material as the same as cigarettes. However, water pipe smoke characterizes with filter absence and more producing of serious gases. Thus, the current stud was sought to determine the toxic effects of water pipe smoking on some minerals parameters such as calcium, magnesium and iron biochemical indicators such as the activity levels of liver enzymes AST and ALT with measuring the bilirubin serum level. The results showed a significant decrease in magnesium level in both types of smokers in comparing with control group. Likewise, the level of Mg in water pipe smoker was lower significantly from cigarette smokers. While, iron level increased significantly in both groups of smokers in comparison with control group and this increasing was obvious in water pipe smokers. No difference was detected in calcium level. The activity of both liver enzymes rose significantly in water pipe and cigarette smokers. Similarly, a noticeable increase in bilirubin level was found in both types of smokers; however the bilirubin was higher in water pipe smoker than in cigarette smokers. In general, the findings indicated clearly to the negative effects of water pipe smokers more than the cigarette smokers.

Key Words: cigarette, water pipe smoking, Biochemical tests, Health issue
Introduction

Smoking has been considered worldwide social habits which cause serious health problems. World Health Organization (WHO) reported that there are four millions persons die as a result of smoking behavior, and this number is likely to arise to 10 million by 2030 (1, 2).

Smoking can be defined as a process where a specific material(s) are burned in order to breath and enjoyment their test. Cigarette smoking represents the most common type of this behavior, in addition to smoke cigar, galion, and water pipe (shesha). In general there are two types of smoking; a positive and negative smoking (breath the smoke which rise from other smoker) (1, 2).

The emitted smoke contains primary from more than 3800 chemical materials and other studies indicated that the smokes consist of more than 4000 toxic materials. Fifty five of them are carcinogen, which can be classified mainly as Polycyclic Aromatic Hydrocarbons PHA (3, 4).

The smoke of cigarette is a complex mixture of chemical compounds; these chemicals are mainly nicotine, tar, carbon dioxide and monoxide, polonium, and ammonia. These agents are well known that these agents cause carcinoma in lung, stomach, esophagus, pancreas, lips, and intestine as well as they definitely lead to adaptation as a consequence of increasing the nicotine serum level (4).

Previous finding pointed out plainly the toxic impacts of smoking on human health Albans et al., (1987) (5) and Chiolero et al. (2008) (6) stated that the body mass index decrease significantly in smokers that can be attributed to the increase in metabolic rate and the reduction in metabolic efficiency as well as loss (7).

Carbon monoxide is one of smoking releases gases which induce hypoxia that by binding with hemoglobin to create carboxyhemoglobin. This process reduces the oxyhemoglobin which in turn causes acceleration in blood acidosis and electrolytes disruption (8).
Iron and magnesium have vital roles in body functions. Iron contributes in metabolic process, gene regulation, cell growth and differentiation as well as oxygen transports (9). While, magnesium is a co-factor for many essential biological reactions such as energy production and ions movement through cell membrane (10). AlAzzawy and Al-Qaicy (11), Mudawi et al. (12) mentioned that the number of Red Blood Corpuscles and Pocket Cell Volume (PVC) increased markedly in smoker compare with non-smokers, that associated contrary with rising of iron serum level. Magnesium serum level decreased significantly in smokers (13).

The biochemical impacts of smoking are evident through changing the liver enzyme activities. Alanine transaminase (ALT), Aspartate aminotransferase (AST), and Alkaline phosphatase (ALP) activity increased significantly, while the billirubin decreased in serum (14).

In the fifteenth century, water pipe smoking (Shesha) was invented in India that it has become popular around the world especially in Asia and Arab land as misunderstanding thought that this kind of smoking is less harm than cigarette smoking (15). Water pipe smokes are mixture of more than 4500 chemical compounds 69 of them are carcinogen and many others induce different types of tumor (16, 17).

Consequently, indisputably, this type of smoking has recognized as a worldwide epidemic health issue (18, 19). Aslam et al. (19) found that water pipe smoking reduces the antioxidant activity and the level of vitamin C in blood. Additionally, smoking one water pipe a day by pregnant women decrease the fetus weight by 100 g (20).

Moreover, cough, chest pain, and high heart rate were detected in high frequency and intensity in water pipe smokers than in cigarette smokers (21). A great attention has been focused on cigarette smoking; conversely, a little interest was given for water pipe smoking. So, the present study aimed to detect the negative effects of this kind of social habits on some biochemical parameters with comparison its results with cigarette smoking.

Material and Methods

1- Sample of the study
Fifty two blood samples were collected from volunteers in Basrah Governorate, Iraq. 14 out of 52 samples were withdrawn from non – smokers and 15 samples received from cigarette smokers, while 23 blood samples were obtained from water pipe smokers (the individuals in this group experience water pipe smoking only and smoke twice a day). These samples were chosen randomly from different places in Basrah city. A participants age ranged between (55 – 86) Kg. Random blood sugar test were made to ensure that all volunteer have the normal range.

2- Serum Preparation

Three milliliters of blood were put in test tube and left for (10 – 15) min. for clotting serum was separated using centrifuge (Germany HERMLL ZzooA) 3500 rpm/min. for 10 minutes. Serum was kept in appendroove tubes in refrigerators (- 4ºC) till performing of the test.

3- Experiments:

A- Aspartate Aminotransferase Enzyme Level measurement (AST):

Biolabo Reagents kit (02160:Maizy, France) was used to determine the AST enzyme activity colometric method was adapted to measure enzyme activity in according to the following reaction (22):

\[ \text{L- Aspartate} + 2\cdot \text{Oxoglutarate} \xrightarrow{\text{AST}} \text{Oxaloacetate} + \text{L-Glutamate} \]

B- Alanine Aminotransferase enzyme Activity measurement (ALT)

ALT activity was determined using Biolabo Reagents kit (02160: Maizy, France) by applying the colometric method that according to (22) as follow:

\[ \text{L- Alanine} + 2\cdot \text{Oxoglutarate} \xrightarrow{\text{ALT}} \text{Pyruvate} + \text{L-Glutamate} \]

C- Calcium level measurement

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Ray and Chauhan (1967) (23) method was adopted to measure calcium serum level that by using Randox kit. Ion level was calculated by applying the following equation:

\[
\text{Calcium Concentration (mg/dl)} = \frac{\text{Serum sample absorption}}{\text{standard sample absorption}} \times \text{standard concentration}
\]

**D- Magnesium level measurement**

Spectrum kit was adopted to determine magnesium ion concentration in serum samples that in accord to (Thomas, 1988) (24) method. The following equation was applied:

\[
\text{Magnesium Concentration (mg/dl)} = \frac{\text{Serum sample absorption}}{\text{Standard sample absorption}} \times \text{standard concentration}
\]

**E- Iron level measurement**

Iron serum level was measured by using Biolabo kit. This colometric method depend on reducing Fe\(^{3+}\) to Fe\(^{2+}\) then forming a colour complex with 3-(2-pyridyl)-5, 6-difuryl-1, -2, - 4Triazine – disulfonate (France). The absorbance was done at 600 nm wave length (tiez, 1999) (25).

The following equation was applied:

\[
\text{Iron concentration (µg/dl)} = \frac{\text{Serum sample absorption (A}2-A1\text{)}}{\text{Standard sample absorption (A}2-A1\text{)}} \times \text{standard concentration}
\]

**6- Total Billirubin level measurement**

Billirubin level was measured by using a colometric method which depend on the reaction between the billirubin and diazotized sulfanilic acid which produce the azobillirubin which colored in very acidic or Alkaline medium. 550 nm wave lengths were used in this test.

Statistical Package for Social Science (SPSS V. 19) software was used to fulfill the statistical analysis. One way ANOVA was applied to detect the differences between the groups. In case of detecting a significant difference in a formational test, then pair wise tests was performed.
to find out the variation between each two groups using Tuky HSD. The probability of $P \leq 0.05$ was used to recognize the significant difference between groups.

**Results**

Serum mineral were measured in two types smokers and non – smokers. The inferential analysis of data showed that the magnesium concentration declined significantly in cigarette and water pipe smokers in comparison with control group. The average of magnesium level in smokers (0.767±0.351, 0.586 ±0.321 mg/dL) in cigarette and water pipe smokers respectively, while it was (2.102±0.302 mg/dL) in control group. Equally, the magnesium decreased considerably (Tab. 1).

Table (1) Effects of water pipe and cigarette smoking on some minerals in blood serum (mean±SD)

<table>
<thead>
<tr>
<th>Groups</th>
<th>Magnesium (mg/dL)</th>
<th>Calcium (mg/dL)</th>
<th>Iron (µg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>2.102±0.302</td>
<td>8.98±2.393</td>
<td>108.895±25.529</td>
</tr>
<tr>
<td>Water pipe smokers</td>
<td>0.586±0.32**▲</td>
<td>8.728±2.421</td>
<td>138.600±33.6**▲</td>
</tr>
<tr>
<td>Cigarette smokers</td>
<td>0.767±0.351**▲</td>
<td>9.158±1.908</td>
<td>114.05±48.82**▲</td>
</tr>
</tbody>
</table>

* Significant at ($P \leq 0.05$)

**Significant at ($P \leq 0.01$)

▲ Significant at ($P \leq 0.05$)

While, non-significant variation was detected in the concentration of calcium ion. (Tab. 2). In case of iron concentration, the current results revealed a significant raise in the level of iron in smoker serum. The mean of this ion was 108.895±25.29 µg/dl in control, non – smoker.
group whereas, the mean of iron concentration increased in both cigarette and water pipe smokers (114.01±48.822 µg/dL and 138.600±33.652 µg/dl respectively. Looking at the means of iron in table (1) It is evident that the iron in water pipe smokers was higher than cigarette smokers.

The statistical analysis of enzyme activity tests, indicated evidently to the occurrence of liver disorder (table, 2). Aspartate aminotransferase enzyme activity showed a significant elevation in smokers P≤0.05. The activity of enzyme in non – smokers was (25.071±7.032) mg/dl, while in the activity increased to (67.733±20.348) mg/dl in cigarette smoker and (68.673±22.735) mg/dl in water pipe smokers.

Alanine aminotransferase activity varied between the volunteers groups and it was significantly high in smokers. However, this variation did not reach to the significant level (table, 2).

Table (2) Effect of water pipe smoking and cigarette on ALT and AST enzymes activity (mean±SD)

<table>
<thead>
<tr>
<th>Minerals</th>
<th>ALT (mg/dL)</th>
<th>AST(mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>22.485±7.871</td>
<td>25.071±7.032</td>
</tr>
<tr>
<td>Water pipe smokers</td>
<td>27.695±12.147</td>
<td>68.673±22.735*</td>
</tr>
<tr>
<td>Cigarette smokers</td>
<td>25.200±10. 800</td>
<td>67.733±20.348*</td>
</tr>
</tbody>
</table>

*Significant at (P≤0.05)

Smoking habits showed an obvious effect on bilirubin level in smoker serum (Fig. 1). The bilirubin level increased significantly in both smoking groups. It was (1.00±0.0379) µg/dl in cigarette smokers and (1.39±0.561) µg/dl in water pipe smokers, while the billirubin level in non – smoker serum was (0.698±0.241) µg/dl. Additionally, it is clear that the billirubin level
in water pipe smokers is higher than the cigarette smokers; however, this difference did not hit the significance (Fig. 1).

Figure (1) Effect of water pipe and cigarette smoking on the bilirubin level in smokers’ serum

Discussion

On the base of current and previous findings, smoking has revealed a serious issue on the human health. (26, 27) Currently, the consequences of cigarette and water pipe smoking were evident with reduction in magnesium level in both groups of smokers. This result clearly agrees with Peacock (28). The possible explanations of this result are; the presence of oxidants and free roots in nicotine which have direct and indirect effect on the oxidative stress of in body as a result of nicotine metabolism (29, 30). Another reason for magnesium decrease in serum of smokers which reported by Winiarczyk (31), that the smoking causes loss of appetite and low absorption rate of minerals in intestine. Additionally, increasing need to magnesium as a result of increasing in both adrenaline excretion and body temperature as response of nicotine effect in tobacco (32).
Current results emphasized the fact that the iron increases dramatically in smokers (12, 33). This outcome is undoubtedly to the incidence of hypoxia which stimulates erythropoietin hormone secretion. In turn this hormone causes hyperplasia in bone marrow that leads primarily to secondary red blood corpuscles production; this mass production facilitates cell destruction, which explains the presence of iron in high level in serum (33, 34, and 35).

Liver enzymes activity increased significantly, this result seems to be constant with Elameen Abdabo (36). This result can be interpreted by increasing the free root which stimulates fat oxidation and liver cellular destruction (36, 37). The raise of nitrogenous content such as nitrous oxide can initiate increasing in neutralisation and elimination of these compounds (38, 39). Moreover, nicotine in cigarette and water pipe smoke causes a direct destruction impacts on liver cells (14).

Bilirubin level increased significantly in both types of smokers. This finding was constant with (40), who found that the total bilirubin rose in male smokers, while decreased in females. Conversely, (13) detected a diminution in bilirubin level in smokers. The prospective reason for this increase may attribute to the raise in red blood corpuscles parameters in smokers (40).

Although, no significant differences were detected between the cigarette and water pipe smoking, the most noticeable point can be seen in these finding that the high negative influence of water pipe in comparison with cigarette smoking. These differences may be related to: firstly, smoking water pipe requires longer time than cigarette smoking (each one water pipe need about 45 minutes). That certainly increases the taken smoke volume (approximately 50-100 times as one cigarette smoke). Secondly, smoking one water pipe daily is equal to smoke 10 cigarettes that increase the harmful effects of water pipe (41, 42).

**Conclusion**

Current analysis of this data revealed unambiguously that smoking water pipe can intensify the adverse influences of smoking habits.

**References**

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هل ان تدخين السجائر والنرجيلة يستحثن نفس التأثيرات السلبية على بعض العوامل البيولوجيّة لمجموعة من المتطوعين/ البصرة، العراق

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خلاصة

بعد التدخين من السلوكات الاجتماعية واسعة الانتشار والتي تسبب العديد من الاضرار الاقتصادية والاجتماعية والصحية. في الآونة الاخيرة شهد المجتمع انتشارا واسعا لتدخين والنرجيلة التي يستخدم فيها التبغ كمادة اولية على حد سواء مع تدخين السكائر. الا ان والنرجيل تتميز بعدم وجود الفلتر مع انبعاث أكثر للغازات الضارة. لذا هدفت الدراسة الحالية إلى بيان التأثير السمي السلبي على بعض المعايير الكيميوية مثل الكالسيوم والمغنيسيوم وال الحديد وانزيمي الكبد ALTAST مع تحديد مستوى البليربون في مصل الدم. بينت النتائج انخفاض مستوى المغنيسيوم بشكل معنوي في المدخنين مع ارتفاع مستوى الحديد معنوي في كل من مدخني السكائر والنرجيلة. بينما لم يظهر الكالسيوم اي اختلاف بين المجامع الثلاث. لوحظ حدوث ارتفاعا معنوي في الانزيمات الكبد مقارنة بمجموعة السيطرة. ويشكل ممثل ارتفاع مستوى البليربون. اظهرت النتائج التأثر السلبي للتدخين بشكل عام مع اشارات لزيادة مستوى الخطر من تدخين النرجيلة.