Effects of Hookah Smoking on Blood Contents and Some Organ Functions of Men Body.

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Abstract

Smoking is the most spreadable habit between people on earth surface impacting human body functions and causing health risks. Our study aimed to estimate cadmium, lead, and iron concentrations in the blood of hookah (Shisha) smokers compared to non-smokers. This project was conducted over a period of time between October (2017) to February (2018) in Najaf province. This period was used to determine smoking hookah effects on heavy elements depositions in blood and organs of smoker's compared to non-smokers. Forty samples of men were measured as a total, divided into 30 samples of smokers and 10 non-smokers. Cadmium, lead, and iron levels were measured in each individual serum. Kidney functions; blood urea, creatinine, and glucose were also examined. Liver functions tests including ALT (Alanine aminotransferase) and AST (Aspartate aminotransferase) were also investigated.

Our results exhibit a significant increase in blood platelets and white blood cell values in smokers while a trend of increasing in hemoglobin values in smokers compared to non-smokers were found not significant. A decreasing in red blood cells of smokers compared with non-smokers was also found non-significant. A significant increase of liver functions in blood of smokers compared to non-smokers were found. Only glucose was significant in smoker's kidney function. There was a marginal significant differences of cadmium in smoker's blood compared to non-smokers. Our study concluded there were a trend of high levels of heavy metals in smokers with high variations in our results. These variations could be related to other factors. More studies focusing on the relationship between organs' functions (e.g. lung) and heavy metals could support our findings by elucidating smoking consequences. Also, considering age, sex, diet, and inheritable status need to be considered in further studies.

Key word: Hookah, Smoking, Blood, Liver, Kidney, Functions.

Introduction:

Heavy metal is defined as metal with a specific weight (<5gm/cm³ or an atomic number more than twenty). Some of heavy metals (e.g. copper) are required and essential to perform biological processes, metabolism, growth, and reproduction [1]. However, they are toxic at relatively high concentration, including lead, copper, zinc, chromium, and cobalt present in a low level inside human tissue (e.g. part per million) [2].

Heavy metals could enter to organism's body through their skin, digestive system, or respiratory system causing functional toxic effects. This could come from their damage interference with the
metabolic processes inside body cells. For example, they could not be removed or dissolved by chemical or physical treatments, which lead to their accumulation in the environment, food contamination, and causing diseases such as cancer [1]. An increase of these heavy metals from their natural range could lead to lethal consequences on animals and human health [3]. Heavy metals in the human body could come from different sources and cause a lot of issues especially their acclamation effects. Smoking Hookah could be a serious source of heavy metals impacting human health's.

Tobacco mixtures used in Hookah pipes could be a source of these heavy metals. Tobacco percentage in hookah could vary. For example, Hookah pipes could be also named as 'Moassel', having mixture of around 30% tobacco, and the remaining 70% is a concoction of flavorings, glycerol and sweeteners (e.g. molasses and honey) [4]. It had been previously found that the water-soluble portion of cigarette smoke represented 38% of the particulate matter [4]. Interestingly, Middle East researchers have subsequently estimated the overall shisha water-filtration rate to be 38%, and concluded that shisha smoke, with only 142 compounds detected in a pipe filled with Jurak (a mixture of 15% of tobacco leaves and 47% carbohydrates (glucose)), is actually far less complex than cigarette smoke [5]. This figure can be compared with the 4,700 substances identified so far in cigarette smoke [6].

Studies indicate that Hookah smokers may inhale more smoke than cigarette smokers during a single smoking session [7]. Experts confirmed that the hookah risk is concentrated through the hookah pipe, placed in the mouth contains more than 30 known chemicals such as (3-Bromoocotane, Benzaldehyde, Zinc, Cadmium, 1-Methylecloheptene etc.) [8]. These chemicals are linked to DNA and thus causes cancer and many genetic mutations [9]. For example, one of the issues from smoking hookah was it contains toxins in the nicotine, which is not filtered with water. Therefore, each dose of hookah is equal to the amount of nicotine in it twice the amount of cigarettes [10].

Moreover, using a one hookah pipe from a mouth of one smoker to another, could rise infection risks by transitional diseases, including cancer, tuberculosis, and hepatitis from one smoker to another by mouth. Moreover, researchers have found that hookah smoking for a period of 30 minutes could lead to a high blood pressure, increased heartbeat, decreased lung functions, reducing blood oxygenation; causing fainting and brain damage. [9].

Also, liver function tests (LFT) are useful tools in clinical practice to assess potential liver diseases and monitor treatment responses. These tests could help to predict prognosis of the patients with liver diseases. LFTs consists from serum total cholesterol (TC), total protein, albumin, alkaline phosphatase (ALP), total bilirubin (TB), aspartate aminotransferase (AST), alanine aminotransferase (ALT), and γ-Glutamyl transferase (GGT). However, the explanation of LFTs should be inclusive and careful because LFTs can be influenced by many personal and environmental factors, including age, gender [11]. Our study will highlight the Hookah smoking effects on blood contents in order to expand understanding of impacts hookah smoking on human health's. For example, in contrast to the vast information and research that have been going on this field to assess the harmful effects of cigarette smoking, studies focusing on the harmful effects of Shisha on the human body are modern and limited. Our study aimed to predict Shisha effects on some blood contents and organ function of males. In order to examine smoking effects on human blood content and organ functions, effects, the following objectives are conducted in our study:

1 - Conducts blood tests and compares their values between smokers to non-smokers to assess smoking hookah effects.
2 - Estimate cadmium, lead, and iron concentrations in the blood of smoker's hookah compared with non-smokers.
3 - Examine smoking hookah duration effects on cadmium deposition rate in smoker's blood tissues compared with non-smokers blood.
4-Assess smoking hookah effects on organ functions such as liver functions.
Material and methods:

The study was conducted at Department of Environment at the Faculty of Science (University of Kufa, Al-Najaf, Iraq) and Al-Sadr Teaching Hospital laboratories labs. This study was designed to measure heavy metals concentration (lead, cadmium, and iron) of smokers' blood in Najaf province and compared those concentrations with nonsmokers' blood.

The project was started from October (2017) to February (2018). Samples of (40) were selected including 30 samples of smoking men and 10 non-smokers as a control group. A field survey was carried out by conducting a questionnaire (Table 1). A questionnaire was used to correlate their results with concentration levels of heavy metals. Their health status showed that they do not suffer from any genetic diseases (e.g. diabetes, pressure, heart disease and atherosclerosis). Smoker group was divided based on smoking duration to the following:

A- First group 18 - 30 years Number = 20
B- The second group is greater than 31 years' number = 10

The hookah smoking period was also divided into:

1- Period 1-4 years = 15
2- Second period is greater than 5 years = 15

Blood samples were collected from smokers and non-smokers blood using sterile specified syringes. Each sample was divided into three groups in tubes:

Group 1: Place the samples in the container tubes on the EDTA coagulation to measure for blood tests, including (Hemoglobin, Packed Cell Volume, White Blood Cell, Red Blood Cell) measured by hematology analyzer.

Group 2: The samples were placed in tubes free of anticoagulant and left at the laboratory temperature for 20 minutes and then placed in the centrifuge at 3000 cycles/minute for the purpose of separating the blood from its components and then the separation of the serum for vital tests, which include AST, ALT measured by using the colorimetric method of Reitman and Frankel [12], Blood Glucose level was measured enzymatic oxidation[13], Creatinine was analyzed by the modified kinetic Jaffe reaction method[14] and Blood urea was measured by enzymatic method using a kit [15] Group 3: for the measurement of heavy metals (Cadmium, Lead and Iron) according to [16].

Statistical analysis:

The statistical program using spss, version16. Program was used to test our study hypotheses using T-test was tested. The values of the standard deviation of each rate were calculated.

Results and Discussion:

Hemoglobin concentrations (HB) levels had highest levels in smokers (15.06 ±1.16 gm /dl) and the lowest in non-smokers (14.92±0.58 gm /dl), but there were no significant differences between their averages (Figure 1, T-test (0.62). This was also observed in previous studies [17,18,19]. When our results showed an increase hemoglobin level this might be return to the smoking effects, increasing in carbon monoxide, balanced by hemoglobin production in blood. For example, smoking increased hemoglobin proportion in blood because of a decreasing in the proportion of oxygenated blood and an increasing of carbon monoxide proportion in the blood of smoking, which may also contribute to the incidence of atherosclerosis as well as acute complications (e.g. stroke) [20].

An increasing platelet level Shisha smokers (245.9 × 10^9/L) compared with non-smokers were found, Fig.2. This increasing was not significant (T-test 0.48, Figure 2). Smoking effects on platelets values could be related to contributing factor. For example, an increases nicotine and cotinine levels caused by smoking induced a prothrombotic state in smokers via increased platelet dependent thrombogenesis [21,20]. Other study found no significant difference in the number of platelets between smokers and nonsmokers [22].
An increasing of white blood cell numbers in people who smoked Shisha (9.5 × 10^9 /L) compared to non-smokers; however, there were no significant differences (Figure3, T-test 0.8). These results were agreed with [23], found that smokers had a higher number of white blood cells compared to nonsmokers. White blood cells are associated with coronary heart disease [24,25], respiratory functions and symptoms [26,27]. Leukocyte increasing might be result from nicotine-induced causing catecholamines production. This could cause blood lymphocyte increasing [28].

Smoking effects on RBCs was not significant. For example, we found a decrease in red blood cells in smokers (4.88 × 10^{12}/L) compared with non-smokers (5.33 × 10^{12}/L), but this decrease was not significant, T test (2.15) figure 4. However, other studies showed that the number of red blood cells was significantly lower in smokers compared to non-smokers [29]. When our results showed non- significant effects on RBCs, this could come from hemolysis of RBCs result from smoking effects on blood content especially hemoglobin.

Liver had impacted by smoking. Smoker's liver function had significantly increased compared nonsmoker's, Table 1. For example, AST and ALT had increased in smoker's blood compared to non-smokers (AST, T-test=2.06, ALT, T-test=1.33). Normally, both of these enzymes have a low level; however, this increasing in our study might return to the smoking effects on liver function, causing this increasing in their levels compared to non-smokers. This was also found in previous studies [30,31]. For example, it was shown that AST increases in smokers compared with nonsmokers [32]. Other findings were also shown an increase of ALT under smoking effects [33].

Smoking effect on kidney functions was detected in our study. We found glucose level had significantly increased in smoker's compared to non-smoker (T-test=, Table 1). This increasing in glucose level may return to the effect of smoking on the sensitivity of insulin function and causing a damage in glucose tolerance. This finding agreed with previous studies [34]. Other measurements such as blood urea and creatinine were also increased in our study; however, their increasing in smokers were not significantly differed to non-smokers (T-test=, Table1). Our results differed from previous studies. For example, it was found that both creatinine and blood urea significantly increased by smoking effects [35] [36]. Surprisingly, we did not found this increasing. This may return to other factors affects our results including sample size (10 non-smokers compared to 30 smokers) as well as inheritable status of our sample.

**Heavy metals:**

When smoking effects can be examined by increasing of heavy metal levels (e.g. cadmium) [37]. In our study, cadmium, lead, iron levels showed a trend of increasing between smokers compared to non-smokers. Although there were a marginal significant effects of smoking; all of these elements were not significantly impacted by smoking effects. For example, the higher rates of cadmium in smoker's blood was (0.18 ppm) compared to non-smoking (0.02 ppm), (p-value=0.07, T-test= 1.8, Figure5). Other study found that smoking effects on cadmium concentrations is only important in young smoker's compared to non-smokers [38], [39]. In our results, an increasing of heavy metal in smoker's blood (e.g. cadmium) levels might come from the nicotine itself, which could directly impact on results. We highly recommend further studies to consider diet, nicotine type, and concentration, which are smokers used. This was also recommended in a previous study [40], [41].

Lead concentrations level in smoker's blood was higher (0.236 ppm) than non-smokers (0.235 ppm) (p-value=0.97, t-test=0.03), Fig.6. This increasing of lead level was not significant. Our study disagreed with previous study [38]. Variabilities of our sample might cause this disagreement with previous studies. For example, type of nicotine, used from person to person, as well as duration of
smoking per day might highly effect on our result. We recommended future studies to considered these variables when they measured heavy metals in blood samples.

Our results showed an increasing of iron level in smoker's blood compared to non-smokers, (2.25) ppm and (1.52) ppm respectively. However, this increasing was not significant in smoker's blood compared to nonsmokers, (p-value= 0.3, t-test=1.04, Fig.7). Our study disagreed with previous study [42]. An increasing in in blood iron level could be expected as result of a deficiency of oxygen and an increasing of hemoglobin to balance this deficiency, result from smoking effects. Surprisingly, this disagreement in our result with previous studies could come from factors, need to be considered in future studies especially dietary system and inheritable status.

The smoking duration effect on cadmium, lead, and iron levels was not significant in our study. Previous study showed that duration of smoking significantly impacts on heavy metal level [42] [43]. We found cadmium was 0.26 ppm in people having duration of smoking more than 5 years (>5) while the lowest value was found in people, having duration of smoking between (1-4) years, 0.10 ppm. (P-value=0.12,T-test = -1.58, Fig.8). Lead concentrations was also showed an increasing rate during the period (> 5 year), 0.24 ppm, but it was not significant (p-value=0.84,T-test= -0.2). Iron element was recorded during the period (1-4) years the highest values were 3.16 ppm, but duration significant (p-value=0.02,t-test=2.48). Concentrations values of cadmium, lead and iron in smoker's blood depending on the age of smokers were also detected in our study. For example, an ages of (18-30) years were found to have the highest values of cadmium, lead and iron (0.194,0.249 and 2.97) ppm respectively (p-value=0.7,t-test= -0.36;p-value=0.8,t-test= -0.27;p-value=0.05,t-test= -1.97.Fig.9) respectively. However, non-significant effects were found in cadmium and lead but significant in iron of our study. This differences in the mean of people, smoking for longer time (>5 yrs) comparing to shorter (1-4 yrs) as well as the age differences of smokers were not significant might be related to our sample variations.

Conclusions:

Our study concludes there were significant increasing of thrombocytes and white blood cells levels in smokers compared to non-smokers blood. However, smoking had increase hemoglobin and heavy metals in smoker's blood; however, this increasing was not significant. In addition, our study concludes that there was a decrease red blood cells in smoker's blood, but this deficiency was not significant between Hookah smokers compared to non-smokers blood. Smoking had significant effects on kidney functions especially on glucose concentration. Creatinine and blood urea not significantly impacted by smoking effects. Liver enzymes significantly impacted by Smoking by increasing AST and ALT compared to non-smokers. Duration of smoking exposure showed a significant effect of iron only. Sample age (18-30 years old) in our study showed a significant factor impacting only iron level in blood. Our study highly recommended to consider sample size, diet, and heritable status to be considered in future studies.

![Figure1](Image)

**Figure1.** Mean levels of hemoglobin in hookah smokers and non-smokers.
**Figure 2.** Mean levels of PLT in hookah smokers and non-smokers.

**Figure 3.** Mean levels of WBC in hookah smokers and non-smokers.

**Figure 4.** Mean levels of RBC in hookah smokers and non-smokers.
Figure 5. Mean of cadmium concentrations in hookah smokers and non-smokers.

Table 1. Mean levels of liver and kidney functions tests in smoking and non-smoking men.

| Parameter       | Smoking (30) | Non smoking | T test |
|-----------------|--------------|-------------|--------|
| Blood Urea      | Mean 28.8    | Mean 27    | 0.30   |
|                 | SD± 13.3     | SD± 7.7    |        |
| Glucose         | Mean 94.4    | Mean 97.2  | -0.67  |
|                 | SD± 12.6     | SD± 8.6    |        |
| Creatinine      | Mean 0.83    | Mean 0.8   | 0.25   |
|                 | SD± 0.13     | SD± 0.12   |        |
| AST U/l         | Mean 24.9    | Mean 17.9  | 2.06   |
|                 | SD± 10.7     | SD± 1.7    |        |
| ALT U/l         | Mean 28.3    | Mean 23    | 1.33   |
|                 | SD± 12       | SD± 6.4    |        |
Figure 6. Mean of lead concentrations in hookah smokers and non-smokers.

Figure 7. Mean of iron concentrations in hookah smokers and non-smokers.

Figure 8. Mean of heavy metals concentrations in hookah smokers according smoking period.
Figure 9. Mean of heavy metals concentrations in hookah smokers according smoking ages.

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