



Hookah Smoking in Incidence with Asymptomatic Gout

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Abstract

Water pipe smoking (WPS) has become very popular worldwide, especially among young people. Its widespread use makes it a risk factor for various diseases. In this study, we hypothesized that water pipe smoking is a cause of asymptomatic gout and prostate cancer and affects salivary pH and serum magnesium (Mg) levels. The study was conducted with 80 participants (60 in the hookah smoking group and 20 in the control group) in Kirkuk, Iraq. Serum uric acid, magnesium (Mg), prostate-specific antigen (PSA), and saliva pH were tested and analyzed for both groups. The result was a significant increase in serum uric acid concentration without any notable changes in saliva pH, serum PSA, and serum magnesium levels. Also, based on tabular data using the Pearson correlation coefficient, a significant positive correlation between waterpipe smoking and serum uric acid levels was examined, but a significant negative correlation between serum PSA and serum Mg levels was assessed. Finally, we also observed small changes in serum uric acid, serum PSA, and serum magnesium levels over extended period (less than 5 years or ≥ 5 years) among waterpipe smokers.

Introduction

Hookah smoking is also known by other names such as water pipe smoking (WPS), shisha, narghile, goza, hubble-bubble, chichi, gaya, madaa, qalyan. It has been reported that there has been a significant increase in its usage worldwide (Maziak *et al.*, 2015). Smoking hurts nearly all body tissues and organs and affects health. According to the World Health Organization (WHO) in 2022, tobacco use causes the deaths of more than 8 million people annually. Hookah smoking can make a person susceptible to many diseases, such as respiratory disease, lung cancer, esophageal cancer, hepatitis C infection, and low birth weight in babies (Waziry *et al.*, 2017, Prasetio *et al.*, 2024, Mahmood *et al.*, 2019). There is evidence indicating that hookah smoking gives rise to obesity, metabolic syndrome, dyslipidemia, and diabetes (Saffar Soflaei *et al.*, 2018).

A lot of research has looked into the

link between smoking and high serum urate levels. Cigarette smoking raises oxidative stress in the body, which may change the levels of uric acid in the blood (Hanna *et al.*, 2010). Uric acid is the last step in the metabolism of purines in humans. It is a compelling water-soluble antioxidant that gets rid of reactive oxygen species (Mikami and Sorimachi, 2017). Although there are few studies on the impact of hookah smoking on prostate cancer and serum magnesium in Iraq, there are no common studies on the influence of water-pipe smoking on lipid profile and oxidative stress (Qasim *et al.*, 2019). Prostate cancer is the second most common diagnosis among men worldwide (Bray *et al.*, 2018). Normal prostatic cells and prostate cancer cells produce prostate-specific antigen (PSA). Thus a small amount of PSA is present in the blood in normal men, but it rises with aging because the prostate becomes larger. A positive association between age and

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PSA levels (Bray *et al.*, 2018, Sultan *et al.*, 2023). High levels of PSA may indicate a problem in the prostate or a sign of prostate cancer (Prcic *et al.*, 2016). pH (potential of hydrogen) can be affected by smoking. There is a powerful relation between the severity of smoking and the pH of saliva (Saputri *et al.*, 2017). A study conducted by Challap *et al.* showed that salivary pH levels decrease in tobacco smokers when compared to non-smokers (Challap *et al.*, 2019).

One of the harmful effects of tobacco smoking is due to alterations in mineral concentrations. Magnesium (Mg) is a vital mineral for life. It functions as a cofactor for several enzymes in different biochemical processes in the body, including protein synthesis, glycolysis, deoxyribonucleic acid (DNA)/ ribonucleic acid (RNA) synthesis, and regulating muscle and nerve function (Gröber *et al.*, 2015, Mardiana *et al.*, 2024, Ibrahim and Hussien, 2023). Magnesium deficiency can be caused by some diseases, including hypertension, cardiovascular disease, type 2 diabetes mellitus, Alzheimer's disease, and migraine headaches. It has been stated that magnesium levels can be affected by tobacco smoking (Kanbay *et al.*, 2012). Hypothetically, hookah smoking causes asymptomatic gout, increases prostate cancer risk, and alters saliva pH and serum Mg levels. To fulfill this assumption, serum uric acid, saliva pH, serum Mg, and serum PSA concentrations were measured.

Methods

Blood samples were taken from 80 participants recruited from Kirkuk city-Iraq, 60 of whom were smokers who used to smoke shisha and used to go to the Arab Cafe, and 20 of them were non-smokers (the control group) between the ages of 18 and 26, who were good health, by taking a medical history through a questionnaire that included Age, marital status, type of smoking, duration of hookah smoking in years, alcohol intake and

chronic diseases. The main exclusion criteria included a history of alcohol consumption, prostate disease, and gout. 4 ml of venous blood samples were drawn. Serum uric acid levels were measured by the uricase enzymatic colorimetric method (Beuschlein *et al.*, 2024). Total prostate antigen was determined by a combination of the enzyme sandwich method with fluorescent immunoassay detection (ELFA) (Verhulst *et al.*, 2025). Magnesium concentration was determined by forming a purple colored complex in an alkaline solution in the presence of EGTA. The saliva pH was measured with a pH paper. The study refers to the ethical principles that have their origin in the Declaration of Helsinki (Approval Number: CH-K26127).

The analysis of the results is presented as (mean $\pm$ SD) values. Student's t-test was applied to compare the mean values between the two groups using the statistical package for social study (SPSS version 25), and Pearson's correlation was applied to show the connection between the parameters and the study group. The P value ($p < 0.05$) was considered an indicator of a statistically significant divergence. The correlation strength analysis was understood as follows: 0.00-0.199 (very weak), 0.20-0.399 (weak), 0.40-0.5999 (medium), 0.60-0.799 (strong), and 0.80 to 1.000 (very strong).

Result and Discussion

The results of the cross-sectional study illustrate serum levels of several parameters in water pipe smokers expressed by Mean $\pm$ SD. Overall, there was a significant increase in serum uric acid concentrations in water pipe smokers in comparison to control group. However, no significant changes were reported in saliva pH, serum magnesium, and serum PSA levels, in contrast to the control. Serum uric acid levels were significantly higher in water pipe smokers at 7.139 ± 1.22 mg/dl [Mean $\pm$ SD] $p < 0.05$ when compared to the control at 5.145 ± 1.016 mg/d (Table 1). No changes were

Table 1. Effect of Hookah Smoking on Some Variables

Variables	Hookah smokers Mean $\pm$ SD	Control Mean $\pm$ SD
Uric Acid (mg/dl)	$7.139 \pm 1.22^*$	5.145 ± 1.016
PSA (ng/ml)	0.620 ± 0.160	0.671 ± 0.232
pH	7.020 ± 0.552	7.000 ± 0.000
Serum magnesium (mg/dl)	1.770 ± 0.539	2.050 ± 0.271

$p < 0.05$ vs. Control *

Table 2. Multivariate Correlation Coefficient Analysis of Serum Uric Acid, PSA and Serum Magnesium in Hookah

Variables	Serum Uric Acid	Serum Magnesium	Serum PSA
	Pearson Correlation Coefficient	Pearson Correlation Coefficient	Pearson Correlation Coefficient
Hookah smokers	0.617**	-0.230	-0.01
Serum magnesium (mg/dl)	-0.161	-	-0.38*
Serum PSA (ng/ml)	0.084	-0.38*	-

**p<0.01, *p<0.05vs control

observed in the levels of serum PSA and saliva pH at 0.620 ± 0.160 ng/ml [Mean $\pm$ SD] $p > 0.05$ and 7.020 ± 0.552 in water pipe smokers when compared to the control at 0.6710 ± 0.232 ng/ml and 7.000 ± 0.000 , respectively. On the other hand, serum magnesium levels decreased in water pipe smokers at 1.770 ± 0.539 mg/dl when compared to the control at 2.050 ± 0.271 mg/dl, although they were not statistically significant $p > 0.05$.

The results in Table 2 demonstrate a relationship among hookah smokers, serum magnesium, PSA, and uric acid using the Pearson correlation coefficient. As can be seen, there was a strong, significant positive correlation between water pipe smokers and serum uric acid levels, while there was a significant negative correlation between serum PSA and serum magnesium levels. The table data clearly show that the Pearson correlation coefficient between hookah smokers and serum uric acid was considerably strongly positive at 0.617. But the correlation coefficient between serum PSA and serum magnesium levels was negative at (-0.38). Also, a weak negative correlation was indicated between hookah smokers and serum magnesium levels at (-0.230), which was statistically not significant. In addition, a very weak negative correlation was indicated between serum magnesium and serum uric acid at (-0.161), which was also not significant.

Table 3 reveals the influence of the period of water pipe smoking on serum uric

acid, magnesium, and PSA. In common, the effect of duration time ≥ 5 years brought an increase in serum uric acid levels, while a decrease in serum magnesium levels, but they were not statistically significant. At a period of smoking less than 5 years, serum uric acid levels non significantly increased at 6.72 ± 1.3 mg/dl [Mean $\pm$ SD] in comparison to control at 5.14 ± 1.016 mg/dl while serum magnesium and PSA levels dropped at 1.93 ± 0.58 mg/dl [Mean $\pm$ SD] and 0.37 ± 0.17 mg/dl in comparison to control at 2.05 ± 0.271 mg/dl and 0.67 ± 0.23 mg/dl respectively, but the findings were not statistically significant. Likewise, for long-term smoking ≥ 5 years, there were no significant differences in the level of serum uric acid and serum magnesium at 7.24 ± 0.95 mg/dl [Mean $\pm$ SD] and 1.59 ± 0.46 mg/dl in comparison to control at 5.14 ± 1.016 mg/dl and 2.05 ± 0.271 mg/dl, respectively. However, serum PSA levels increased nonsignificantly at 0.89 ± 0.34 mg/dl [Mean $\pm$ SD] in comparison to control at 0.67 ± 0.23 mg/dl.

In the current study, we have investigated that hookah smoking significantly raises serum uric acid concentrations. This smoking did not significantly affect either serum PSA or saliva PH and serum magnesium levels compared to the control (Table 1). It is supported by other works showing that serum uric acid concentrations are greater in hookah smokers compared to the control group (Li *et al.*, 2025). In contrast, inverse outcomes indicated that smoking can reduce serum uric acid concentrations (Liu *et*

Table 3. Effect of Hookah Smoking Duration on Some Biochemical Variables of Smokers (Serum Uric Acid, Serum Magnesium, and Serum PSA)

Duration	Serum uric acid (mg/dl) Mean $\pm$ SD		Serum magnesium (mg/dl) Mean $\pm$ SD		Serum PSA (ng/ml) Mean $\pm$ SD	
	Hookah Smokers	Control	Hookah Smokers	Control	Hookah Smokers	Control
Less than 5 years	6.72 ± 1.3	5.14 ± 1.016	1.93 ± 0.58	2.05 ± 0.271	0.37 ± 0.17	0.67 ± 0.232
≥ 5 years	7.24 ± 0.95		1.59 ± 0.46		0.89 ± 0.34	

et al., 2000). Serum uric acid can act as a pro- or anti-oxidant compound in the body (Kang and Ha, 2014). In vitro study indicated that serum uric acid acts as an antioxidant and combats free radicals and ROS. Several different toxic compounds, ROS, and free radicals have been investigated in cigarette, which causes oxidative stress (Arnson *et al.*, 2010).

A study conducted by Jun Li, *et al.* reported that PSA decreases by 8-12 % in smoking men compared to non-smokers (Li *et al.*, 2012). In contrast, older African American men with a cigarette smoking history were positively correlated with an elevation in PSA levels, while for marijuana smokers, there was an opposite correlation with PSA levels (Press *et al.*, 2020). In addition, serum Mg levels significantly decreased in smokers who smoked more than 15 cigarettes per day (Mudawi *et al.*, 2013). However, another study referred that cigarette smoking doesn't significantly affect Mg level (Meral and Akdemir, 2015). On the other hand, research pointed out that tobacco smoking results in a decline in salivary pH (Grover *et al.*, 2016).

The results also showed a significantly elevated positive correlation of water pipe smoking with serum uric acid concentrations. Unlike, a significant negative correlation coefficient was revealed between serum magnesium and serum PSA levels (Table 2). This study is in agreement with (Li *et al.*, 2025), who found a significant positive correlation between smoking status and serum uric acid concentrations. However, different studies have indicated a negative relationship between smoking and serum uric acid levels (Haj Mouhamed *et al.*, 2011). Also, a high negative correlation has been found between smoking signals and serum magnesium levels (Rahman *et al.*, 2025). There is evidence indicating that low magnesium levels are significantly associated with prostate cancer (Gong *et al.*, 2025).

Moreover, our findings revealed that there are no significant effects of the duration (less than 5 years or ≥ 5 years) of WPS on the levels of serum uric acid, serum magnesium, and serum PSA (Table 3). Whereas a significant decline of serum uric acid concentration has been reported when the smoking period exceeds

5 years (Haj Mouhamed *et al.*, 2011). Previous studies have shown that serum magnesium levels are significantly decreased with severity and duration of smoking as a consequence of a drop in appetite and a decrease in absorption (Unkiewicz-Winiarczyk *et al.*, 2009). The limited sample size used in this study may affect the statistical significance of the results, and the effects of hookah smoking could be comprehensible if it were based on prospective study.

Conclusions

Hookah smoking was a significant cause of high serum uric acid levels. It also induced a slight change in the levels of serum PSA and serum magnesium. There is a statistically significant positive correlation between hookah smokers and serum uric acid levels, while a significant negative correlation between serum PSA and serum magnesium levels in hookah smoker groups. The effect of duration time (less than 5 years or ≥ 5 years) of water pipe smoking does not significantly alter serum uric acid, serum PSA, and serum magnesium levels.

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