

## Serotonin, Endorphin Concentrations and Some Hematological Parameters in Male Narghile Smokers

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### Abstract

This study was carried out to evaluate the relationship between narghile smoking and serum concentration of serotonin and endorphin and some blood hematological indices in males. Group of smokers composed of 50 voluntary, and control group composed of 36 healthy voluntary. This study was conducted on adults man that ages between (18-25 years). The markers measured in this study were serum serotonin and endorphin and hematological indices (platelets, hematocrit, hemoglobin, and white blood cells).

This study showed a significant decrease ( $P < 0.05$ ) in levels of serum serotonin, endorphin and blood platelets, and a significant increase ( $P < 0.05$ ) in levels of in blood hematocrit and hemoglobin and a non-significant increase of white blood cells ( $P > 0.05$ ) in smokers as compared with healthy persons.

### Introduction

A hookah is also known as a water pipe, shisha, narghile, argile or goza. "hubble-bubble" or "hubblybubbly" is the more informal term used by some[1]. Tobacco use is responsible for about 5 million deaths per year. Tobacco use is the 2nd major leading cause of death and is currently responsible for the deaths of one in ten adults' across the world. Shisha is familiar to about 1 billion people throughout the world and is daily used by more than 100 million men and women in Africa, Asia and several Mediterranean countries. The shisha had been smoked for at least 400 years. At present, Shisha is becoming an increasingly popular way of tobacco use worldwide[2,3].

Water pipe (WP) smoking is growing as an alternative to cigarette smoking, especially in younger age groups. A majority of smokers mistakenly believe that WP smoking is a social entertainment practice that leads to more social behavior and relaxation and that this type of smoking is safe or less harmful than cigarette smoking[4].

#### The Structure and Function of the Waterpipe (Narghile)

The narghile is a tobacco-smoking instrument. It is composed of a bowl at the top, a body, a pipe with a mouthpiece, and a glass bottle at the base of the instrument to hold the water. Tobacco is burned in the top bowl of the narghile by burning coal embers

next to the tobacco. Suction through the mouthpiece draws the smoke through the water in the glass bottle and then into the mouth and the lungs of the smoker[5].

Contrary to common impressions, the narghile does not protect smokers from the tar in the smoke[6]. Narghile smoke contains an increased concentration of tar and volatile carcinogens. This is supported by a recent study on the composition of the smoke aerosol of the Narghile water pipe. Narghile smokers are also exposed to carbon monoxide (CO), which is generated by incomplete burning of carbon fuels. By combining with hemoglobin, carboxyhemoglobin (COHB) is formed, reducing the oxygen-carrying capacity of the blood[7,8].

Serotonin (5-hydroxytryptamine; 5-HT) is a neurotransmitter widely synthesized in the central nervous system (CNS) and is also found in gastrointestinal mucosa cells and blood platelets. It is an intermediate product of tryptophan metabolism and is located primarily in the enterochromaffin cells of intestine, serotonergic neurons of the brain, platelets of the blood and is well established as a neurotransmitter in the central nervous system. Platelets serve as the major reservoir of serotonin in the bloodstream[9-11].

Endorphins are endogenous opioid biochemical compounds. They are polypeptides produced by the

pituitary gland and the hypothalamus in vertebrates, and they resemble the opiates in their abilities to produce analgesia and a sense of well-being. In other words, they might work as "natural pain killers"[12].

#### Aim of the study:

This study was done to detect if there was an alteration in serum concentration of serotonin and endorphin and some hematological indices in persons smoking narghile alone and with cigarettes.

#### Subjects and Methods:

This study included 86 person (50 smokers, and 36 healthy persons), and the age was ranged between (18-25 years for these two groups). This study was conducted from September, 2016 till March 2017 in Tikrit city.

Instruments used was Enzyme Linked Immunosorbent Assay (ELISA) for measuring of serotonin and endorphin. Coulter Counter (Autoanalyzer) was used for estimation of platelets, hemoglobin, hematocrit and white blood cells.

**Table (1): Distribution of samples**

Groups	Number of Samples
Group 1 (Narghile smokers only)	29 person
Group 2 (Cigarette smokers only)	21 person
Group 3 (Narghile and cigarette smokers (whole smokers))	50 person
Control group	36 person

### Biochemical Analysis

#### 1- Human Serum Serotonin Assay

Serotonin was determined by ELISA kit (IBL international GmbH, Hamburg, Germany). Enzyme immunoassay for the *in vitro* diagnostic quantitative determination of Serotonin in human serum, plasma, platelets, urine. Further the test can be used for research of tissue homogenates and cell culture supernatants.

#### 2- Human Serum Beta-Endorphin Assay

Endorphin was determined by ELISA kit (USCNLIFE, for research use only). This immunoassay kit allows for the use *in vitro* quantitative determination of human Beta-Endorphin,  $\beta$ -EP concentrations in cell culture supernates, serum, plasma and other biological fluids.

#### 3- Haematological Parameters Assay

Coulter counter (Autoanalyzer, Bayer, Germany) was used in the determination of platelets (Plt), hemoglobin (Hb), hematocrit (Hct), and white blood cells count (WBC).

#### Biostatistical analysis:

The results were expressed as mean  $\pm$  standard deviation (SD). Students t-test and bivariate correlation [Pearson correlation coefficient (r)] was used for assessment the results of patients and control groups. Significant variation was considered when P value less than 0.05.

### Results

1- Biochemical and hematological parameters in whole smokers and non-smokers.

Serum serotonin, endorphin, and blood platelets were significantly decreased ( $P < 0.05$ ) in smokers as

compared with non-smokers, while blood hematocrit, and hemoglobin were significantly increased ( $P < 0.05$ ) in smokers in relation with non-smokers, white blood cells also increased but in a non-significant value ( $P > 0.05$ ), as noted in table(1).

2- Biochemical and hematological parameters in narghile smokers (N S) and non-smokers.

Serum serotonin, endorphin, and blood platelets were significantly decreased ( $P < 0.05$ ) in smokers as compared with non-smokers, while blood hematocrit was significantly increased ( $P < 0.05$ ) in smokers in relation with non-smokers, white blood cells and hemoglobin were also increased but in a non-significant value ( $P > 0.05$ ), as shown in table(2).

3- Biochemical and hematological parameters in cigarette smokers (CS) only and non-smokers.

Serum serotonin, endorphin, and blood platelets were significantly decreased ( $P < 0.05$ ) in smokers as compared with non-smokers, while blood hematocrit and hemoglobin were significantly increased ( $P < 0.05$ ) in smokers in relation with non-smokers, white blood cells also increased but in a non-significant value ( $P > 0.05$ ), as shown in table(3).

4- Biochemical and hematological parameters in whole smokers and in only narghile smokers.

Serum serotonin, and blood platelets were significantly decreased ( $P < 0.05$ ) in whole smokers as compared with only narghile smokers, also endorphin was decreased but in a non-significant value ( $P > 0.05$ ), while blood hematocrit, hemoglobin and white blood cells were increased in a non-significant value ( $P > 0.05$ ), as shown in table(4).

**Table (2): Biochemical and hematological parameters in whole smokers group (group 3) and control group.**

Groups	Sero. (ng/ml) $\pm$ S.D	End. (pg/ml) $\pm$ S.D	Plt ( $\times 10^3/\text{mm}^3$ ) $\pm$ S.D	Hct (%) $\pm$ S.D	Hb (g/dl) $\pm$ S.D	WBCs ( $\times 10^3/\text{mm}^3$ ) $\pm$ S.D
Group 3 (n=50)	88.58 $\pm$ 16.65	4.00 $\pm$ 0.39	204.96 $\pm$ 27.32	51.02 $\pm$ 3.02	16.39 $\pm$ 0.94	5.51 $\pm$ 0.52
Control Group (n=36)	129.40 $\pm$ 13.14	5.53 $\pm$ 0.53	245.00 $\pm$ 31.49	45.06 $\pm$ 1.82	14.61 $\pm$ 0.49	5.29 $\pm$ 0.44
P <sub>value</sub>	0.001	0.05	0.01	0.05	0.05	0.15

**Table (3): Biochemical and hematological parameters in narghile smokers group (group 1) and control group.**

Groups	Sero. (ng/ml) ±S.D	End. (pg/ml) ±S.D	Plt (x10 <sup>3</sup> /mm <sup>3</sup> ) ±S.D	Hct (%) ±S.D	Hb (g/dl) ±S.D	WBC (x10 <sup>3</sup> /mm <sup>3</sup> ) ±S.D
Group 1 (n=29)	99.54 ±9.07	4.27 ±0.21	220.45 ±21.80	48.83 ±1.37	15.39 ±0.35	5.38 ±0.40
Control Group (n=36)	129.40 ±13.14	5.53 ±0.53	245.00 ±31.49	45.06 ±1.82	14.31 ±0.49	5.29 ±0.44
P <sub>value</sub>	0.01	0.01	0.05	0.05	0.08	0.39

**Table (4): Biochemical and hematological parameters in only cigarette smokers group (group 2) and control group.**

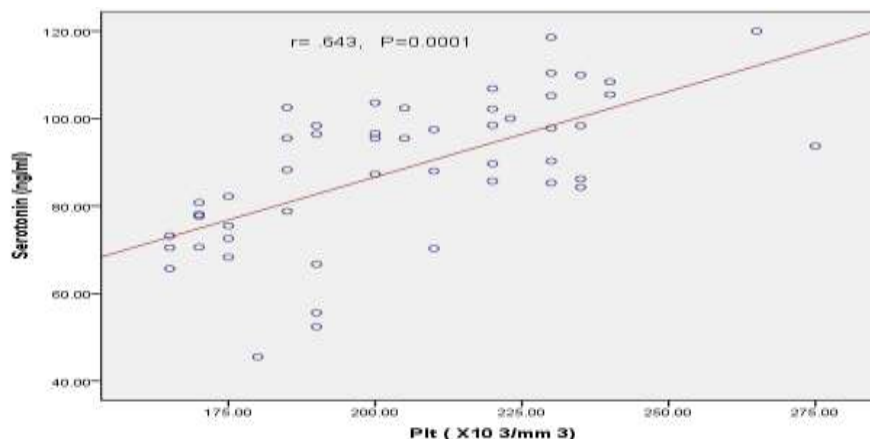
Groups	Sero. (ng/ml) ±S.D	End. (pg/ml) ±S.D	Plt (x10 <sup>3</sup> /mm <sup>3</sup> ) ±S.D	Hct (%) ±S.D	Hb (g/dl) ±S.D	WBC (x10 <sup>3</sup> /mm <sup>3</sup> ) ±S.D
Group 2 (n=21)	73.45 ±12.22	3.63 ±0.25	183.75 ±18.31	54.05 ±1.77	17.25 ±0.57	5.63 ±0.51
Control Group (n=36)	129.40 ±13.14	5.53 ±0.53	245.00 ±31.49	45.06 ±1.82	14.31 ±0.49	5.29 ±0.44
P <sub>value</sub>	0.001	0.01	0.001	0.01	0.01	0.09

**Table (5): Biochemical and hematological parameters in whole smokers group (group 3) and in only narghile smokers group (group 1).**

Groups	Sero. (ng/ml) ±S.D	End. (pg/ml) ±S.D	Plt (x10 <sup>3</sup> /mm <sup>3</sup> ) ±S.D	Hct (%) ±S.D	Hb (g/dl) ±S.D	WBC (x10 <sup>3</sup> /mm <sup>3</sup> ) ±S.D
Group 3 (n=50)	88.58 ±16.65	4.00 ±0.39	204.96 ±27.32	51.02 ±3.02	16.39 ±0.94	5.51 ±0.52
Group 1 (n=29)	99.54 ±9.07	4.27 ±0.21	220.45 ±21.80	48.83 ±1.37	15.39 ±0.35	5.38 ±0.40
P <sub>value</sub>	0.05	0.09	0.05	0.08	0.09	0.4

**Table (6): Correlation of serotonin and endorphin with platelets, hemoglobin and hematocrit.**

Markers	Serotonin		Endorphin	
	r	P <sub>value</sub>	r	P <sub>value</sub>
Plt	0.643	0.0001	0.707	0.0001
Hb	-0.942	0.0001	-0.930	0.0001
Hct	-0.958	0.0001	-0.950	0.0001



**Figure (1): The association between serum serotonin and blood platelets in whole smokers.**

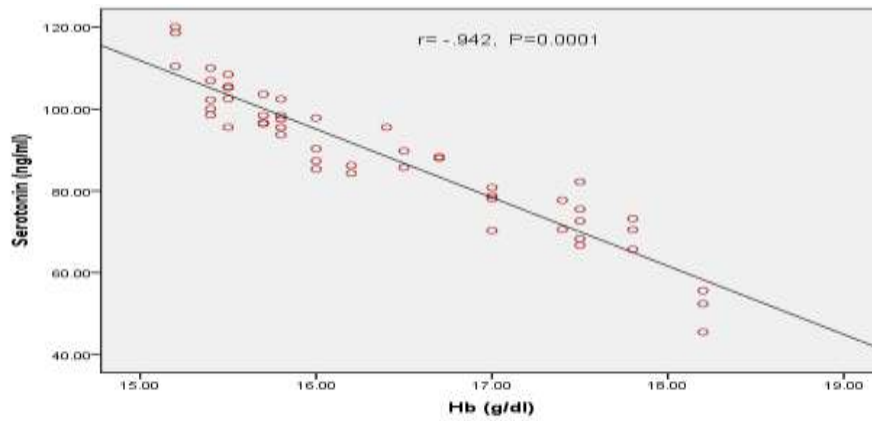


Figure (2): The association between serum serotonin and blood hemoglobin in whole smokers.

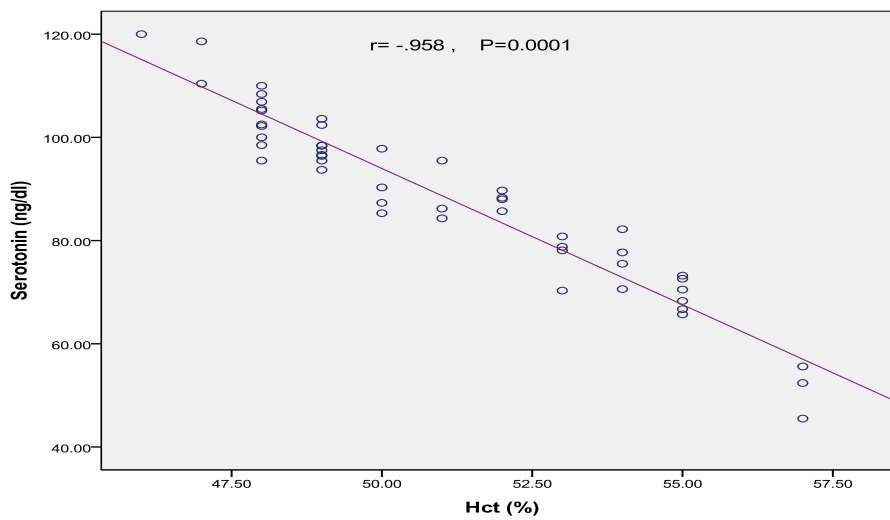


Figure (3): The association between serum serotonin and hematocrit in whole smokers.

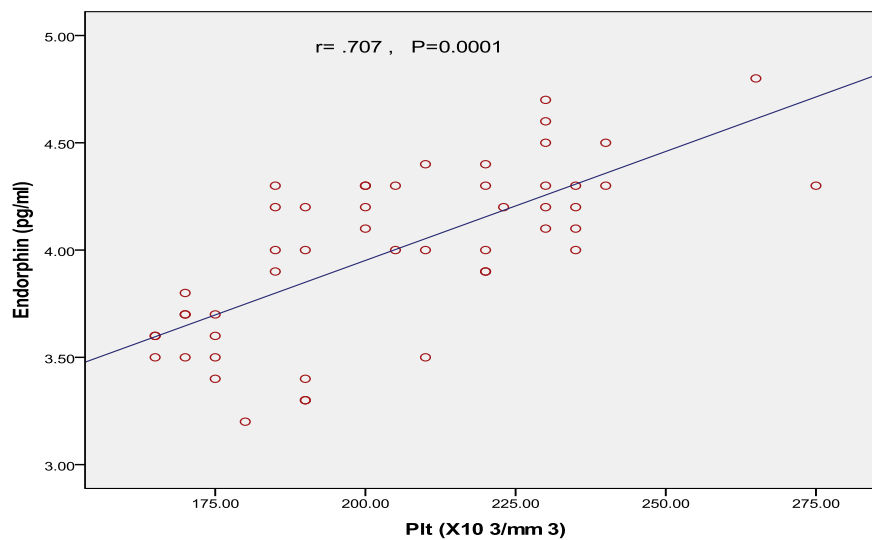


Figure (4): The association between serum endorphin and blood platelets in whole smokers.

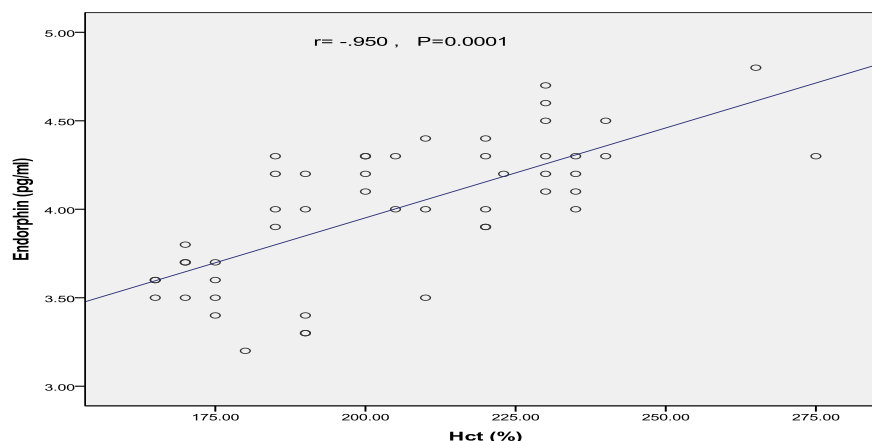


Figure (5): The association between serum endorphin and blood hematocrit in whole smokers.

### Discussion

The results showed a significant decrease in the levels of serum serotonin, endorphin and blood platelets count and a significant increase in hemoglobin and blood hematocrit, white blood cells was increased in a non-significant value, these in whole smoker persons (narghile and cigarette smokers) as compared with non-smokers. However; Saiem Al-Dahr[3] mentioned that there was a significant increase of hemoglobin, hematocrit, and white blood cells and a non-significant decrease of platelets. Alsahen [13] explain the increase in white blood cells count which may be a marker of exposure to oxidants, the inflammatory response to oxidants.

Kremer [14] mentioned that smoking will further reduce serotonin levels, thus exacerbating the dependence on nicotine in subjects with a more transcriptionally efficient transporter gene.

In this study there was a significant decrease in concentrations of serum serotonin and endorphin and blood platelets count and a significant increase in hemoglobin and blood hematocrit, white blood cells was increased in a non-significant value, these in whole smoker persons as compared with narghile smokers only. Malone[11] showed that the cigarette

### References

- 1- Amir AR, Behrad D, Afshin K, Yadollah SS, Amirreza R, and Siamak Y. Effect of Hubble-Bubble Smoking on Oral Health. *Bull. Env. Pharmacol. Life Sci.*, 2014; 3(12): 52-59.
- 2- Aslam HM, Saleem S, German S and Qureshi WA. Harmful effects of shisha: literature review. *International Archives of Medicine*, 2014;7:16.
- 3- Saiem Al-Dahr MH. Impact of Smoking on Platelet, Coagulation and Lipid Profile in Young Male Subjects. *World Applied Sciences Journal*, 2010; 11(1): 118-123.
- 4- Fromme H and Schober W. Waterpipes and e-cigarettes: Impact of alternative smoking techniques on indoor air quality and health. *Atmospheric Environment*, 2014; 1-13.

smokers had significantly lower concentrations of serotonin and the serotonin metabolite 5-hydroxyindoleacetic acid (5-HIAA), and higher serotonin<sub>1A</sub> (5-HT<sub>1A</sub>) receptor density, thus, smoking may eventually impair serotonin function. Saiem Al-Dahr [3] noted that blood platelets, hemoglobin and white blood cells were significantly increased in cigarette smokers as compared with narghile smokers and with non-smokers (cigarette smokers showed a significant high value than shisha smokers). Serotonin concentration is highly positive correlated with platelets count ( $r = .643$ ,  $p = 0.0001$ ) and a highly negative correlated with hemoglobin and hematocrit ( $r = .942$ ,  $p = 0.0001$ ) and ( $r = .958$ ,  $p = 0.0001$ ) respectively.

Also endorphin concentration is highly positive correlated with platelets count ( $r = .707$ ,  $p = 0.0001$ ) and a highly negative correlated with hemoglobin and hematocrit ( $r = .930$ ,  $p = 0.0001$ ) and ( $r = .950$ ,  $p = 0.0001$ ) respectively.

This results of correlation may be due to increase of oxidants of smoking which lead to decrease synthesis of platelets, serotonin and endorphin and increase hemoglobin and hematocrit levels.

- 5- Urkin J, Ochaion R and Peleg A. Hubble Bubble Equals Trouble: The Hazards of Water Pipe Smoking. *The Scientific World Journal*, 2006; 6: 1990–1997.
- 6- Gieringer DH. Marijuana Water Pipe and Vaporizer Study. *Newsletter of the Multidisciplinary Association for Psychedelic Studies (MAPS)*, 2000; 6(3):1–6.
- 7- Shihadeh A. and Saleh R. Polycyclic aromatic hydrocarbons, carbon monoxide, “tar”, and nicotine in the mainstream smoke aerosol of the narghile water pipe. *Food Chem. Toxicol.*, 2005; 43(5):655–661.
- 8- Shafagoj YA, Mohammed FI, and Hadid KA. Hubble-bubble (water pipe) smoking: levels of nicotine and cotinine in plasma, saliva and urine. *Int. J. Clin. Pharmacol. Ther.*, 2002; 40(6):249–255.

9- Jørgensen HS. Studies on the neuroendocrine role of serotonin. Dan Med Bull, 2007;54:266-88.  
10-Harenberg J, Huhle G, Giese Ch, et al. Determination of serotonin release from platelets by enzyme immunoassay in the diagnosis of heparin-induced thrombocytopenia. British Journal of Hematology, 2000;109:182-186.  
11- Malone KM, Waternaux C, Haas GL, Cooper TB, Li S, and Mann JJ. Cigarette Smoking, Suicidal Behavior, and Serotonin Function in Major Psychiatric Disorders. Am J Psychiatry, 2003; 160: 773–779.  
12-Arbol JL, MunÄoz JR, Ojeda L, et al. Plasma concentrations of beta-endorphin in smokers who

consume different numbers of cigarettes per day. Pharmacology, Biochemistry and Behavior, 2000; 67: 25 – 28.  
13-Asalhen KS, and Abdalsalam RD. Effect of cigarette smoking on liver functions: a comparative study conducted among smokers and non-smokers male in El-beida City, Libya. International Current Pharmaceutical Journal, 2014; 3(7): 291-295.  
14-Kremer I, Bachner - Melman R, Reshef A, et al. Association of the Serotonin Transporter Gene With Smoking Behavior. Am J Psychiatry, 2005; 162(5): 924–930.

## تراكيز السيروتونين والاندورفين وبعض المتغيرات الدموية لدى الرجال المدخنين للترجيئة

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### الملخص

تم اجراء هذه الدراسة لتقييم تأثير تدخين الترجيئة على مستوى السيروتونين والاندورفين وبعض المتغيرات الدموية للرجال. مجموعة المدخنين متكوّنة من 50 متطوع مدخن، ومجموعة قياسية متكوّنة من 36 متطوع سليم. تم اجراء هذه الدراسة على الرجال الذين تتراوح اعمارهم بين (18-25 سنة). في هذه الدراسة تم قياس تركيز السيروتونين والاندورفين وكذلك قياس المتغيرات الدموية (الصفائح الدموية، اللزوجة، الهيموغلوبين، وعدد خلايا الدم البيض). بينت هذه الدراسة عن وجود نقصان ملحوظ ( $P<0.05$ ) في تركيز السيروتونين والاندورفين وعدد الصفائح الدموية وزيادة ملحوظة ( $P<0.05$ ) في نسبة لزوجة الدم وتركيز الهيموغلوبين بينما هنالك زيادة غير ملحوظة ( $P>0.05$ ) في عدد خلايا الدم البيض في المدخنين مقارنة بالاصحاء.