



## Effect of smoking on reproductive hormones and glucose in Adults Men

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### Abstract

The prevalence of the phenomenon of smoking affects 4 to 6 million people annually with disorders of the metabolic and endocrine system, including sex hormone binding globulin (SHBG): a glycoprotein made by hepatocytes. This study attempted to explain the changes in hormones and some physical characteristics in people who smoke regularly. The total volunteers for this study were 87 men who were divided into two groups: 31 controls (non-smokers) and 56 smokers with no significant differences in their age., Chemical analysis revealed there was a significant increase in the levels of SHBG in smokers (p value < 0.05), with no change in the levels of testosterone, compared to the controls. The results demonstrate also a positive correlation between fasting blood glucose level and the number of cigarettes, the smoking duration, and waist circumference in people who smoke. It could be concluded that, excessive smoking has a strong impact on blood sugar levels and may be a main cause for diabetes mellitus (DM).

Keywords: Sex hormone binding globulin (SHBG), Diabetes mellitus DM, waist circumference WC, Body mass index (BMI),

### 1. Introduction

Smoking is a widely spread phenomena around the world, where cigarettes contain many chemical components 1. Until now, smoking remains the main cause of increasing the death cases and many diseases resulting from reproductive disorders, the prevalence of this phenomenon is due to increased social and economic pressures 2. Chronic smoking causing disorder in endocrine system balance leading to high levels of cortisol, growth hormone, sex hormone binding globulin and prolactin as results impairment fertilization for both sexes 3. Previous studies were not clear of smoking effects on testosterone level which were varied between high and low 4. Sex hormone binding globulin (SHBG) is glycoprotein that creates by hepatocytes; and then excreted to blood stream 5,6. Possessing low attraction for B17 Hydroxy steroid hormone such as, Estradiol (E2), Dehydropaindosterone; (DHEA) and height affinity to testosterone which is closely linked with SHBG by 40% in males 7. SHBG regulates that activity of sex hormones (estrogen and androgen) which are responsible for female and male sexual characteristics 8, and also represents keeping delivery for these mentioned hormones for target tissue 9. SHBG itself can elicit a role and become more effective by bind free fraction with specific receptor (free hormone hypothesis) 10. Although accretion the public fears of

smoking and its correlation with cardiovascular and lung disease, its much less knowledge about nicotine effects on balance of endocrine secretion. The current study tries to elucidate the effect of nicotine on SHBG level in smoking male and brevity the biological activity changes that suffered smoking men.

#### 1. Experimental:

The present study was conducted on eighty- seven adult men; all volunteers were representing as collegians and employers of Diyala University /Iraq. This study extended from March to June 2021. The subjects were divided into two groups: 31 nonsmokers as control, their matched with 56 apparently healthy smokers, their ages were between 17-55 year. Approximately 5 ml of blood from each sample were supplied from fast left venous by applying tourniquet at (8- 10) am, and then centrifuged at 3000 rpm to separate the blood contents, clotting was removed, the remain serum was stored at -20°C until use. Basal characterize have been chosen without any treatment and had no clinical history for other disease. Many physical measurements were applied to all collected specimens such as: blood pressure (by traditional auscultation methods), waist circumferences in cm unit and height with weigh to calculate body mass index (BMI):by divided in weight (in Kg) on square of the height (m<sup>2</sup>), 11, it was collected directly from donors, because of its direct association with hormone

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changes. The drawn blood was collected to analyze chemical parameters after stop eating at least 8-10 hours. Serum SHBG, and serum testosterone, were determined by ELIZA test using commercially available kit from Demeditec Diagnostics (Germany) and Fasting Blood glucose by Cobas device. Data were analyzed using the computer facility with available statistical packages of SPSS **16**. Data was presented in simple measure of number, mean, SE and the parametric statistical tests were used namely ANOVA to test the significance of difference in mean between more than two groups, while student t-test for independent samples was used to test the difference in mean between two groups. P value equal and less than 0.05 were considered as the level of significance

## 2. Results:

The current study illustrated 56 regular smoking men where the number of cigarettes per day does not decrease for them from 8 cigarettes. Information was collected for all volunteers as shown in table (1): 56 smoking men, age range, (Mean  $\pm$  SE) (31.20  $\pm$  1.72 years) and 31 controls (Mean  $\pm$  SE) (31.01  $\pm$  2.43 years), which does not appear a significant difference between them, further more there's no significant differences in their blood pressure, where systolic and diastolic: (Mean  $\pm$  SE) in smoking (13.1  $\pm$  0.23) (7.66  $\pm$  0.12) comparing with nonsmoking (Mean  $\pm$  SE) (11.92  $\pm$  1.08) (7.46  $\pm$  0.15) respectively. Table (1) express a similarity in mean BMI (Kg/M<sup>2</sup>) between the two categories smokers (26.6  $\pm$  1.66) and nonsmokers (27.90  $\pm$  1.06). Finally, the results of this study indicated that there is a similarity between Smokers and non-smokers in Waist Circumference (36.32  $\pm$  0.56), (34.96  $\pm$  0.45), respectively.

**Table (1): general description of the samples**

Parameters	Groups	N	Mean $\pm$ SE
Age (year)	Smokers	56	31.20 $\pm$ 1.72
	non	31	31.01 $\pm$ 2.43
BMI (kg/m <sup>2</sup> )	Smokers	56	26.60 $\pm$ 1.66
	non	31	27.90 $\pm$ 1.06
DBP (mmHg)	Smokers	56	7.66 $\pm$ 0.12
	non	31	7.46 $\pm$ 0.15
SBP (mmHg)	Smokers	56	13.10 $\pm$ 0.23
	non	31	11.92 $\pm$ 1.08
WC (cm)	Smokers	56	36.32 $\pm$ 0.56
	non	31	34.96 $\pm$ 0.45

BMI: body mass index, DBP: diastolic blood pressure, SBP: systolic blood pressure. WC: Waist circumference

Table (2): refers to the hormonal changes that are likely to be affected by smoking, where it was found a significant difference in SHBG hormone ( $p < 0.05$ )

in smoking (56 men) which were much higher than non-smoking (31 men), (Mean  $\pm$  SE) (83.45  $\pm$  5.17, via (61.67  $\pm$  5.96) respectively. At variance SHBG, table 2 shows there were no significant differences in testosterone hormone, where the testosterone levels were nearly same when comparing between smoking group (Mean  $\pm$  SE) (3.55  $\pm$  0.26) with non-smoking (4.50  $\pm$  0.49) ( $p$  value  $\geq 0.005$ ).

Otherwise, the present results showed that there were non-significant differences in glycaemia level ( $p$  value  $\geq 0.005$ ) between smokers (Mean  $\pm$  SE) (5.76  $\pm$  0.26) and control group (5.36  $\pm$  0.25) as shown in table (2).

**Table (2): Hormonal changes between the two groups (smokers and non-smokers)**

Parameters	Groups	N	Mean $\pm$ SE	Sig < 0.05
SHBG (nmol/l)	Smokers	56	83.45 $\pm$ 5.17	0.04
	non	31	61.67 $\pm$ 5.96	
Testosterone (ng/ml)	Smokers	56	3.55 $\pm$ 0.26	0.63
	non	31	4.50 $\pm$ 0.49	
Fasting Blood glucose (mmol/l)	Smokers	56	5.76 $\pm$ 0.26	0.27
	non	31	5.36 $\pm$ 0.25	

SHBG: sex hormone binding globulin. FBG: Fasting Blood glucose. \* Significant differences ( $p \leq 0.05$ ).

Table (3) divided duration of smoking to three categories, according to increasing of smoking period: first group 3-7 years, second group 7-10 years and third group more than 10 years, including 12, 21, 23 men respectively. SHBG hormone have been noticed significantly increasing in the second group, (Mean  $\pm$  SE) (86.24  $\pm$  6.90) when compare them with the first group (78.20  $\pm$  12.81) ( $p$  value  $< 0.05$ ), those differences occurred between the first and the second group only, unlike advanced stage of smoking, where observed no significant differences in SHBG with increasing of smoking period for second and third categories ( $p$  value = 0.26, 0.45) respectively.

Table (4) illustrated by Pearson's correlation coefficients the relation of several variables such as number of cigarettes, smoking duration and waist circumference with diabetes mellitus (DM) in smokers only. Through this statistical analysis, the current study found the levels of blood glucose has a positive correlation with each of number of cigarettes ( $r = 0.35$ ,  $p = 0.006$ ), and smoking duration ( $r = 0.48$ ,  $p = 0.00$ ). In addition to the positive correlation between blood glucose and WC ( $r = 0.34$ ,  $p = 0.008$ ).

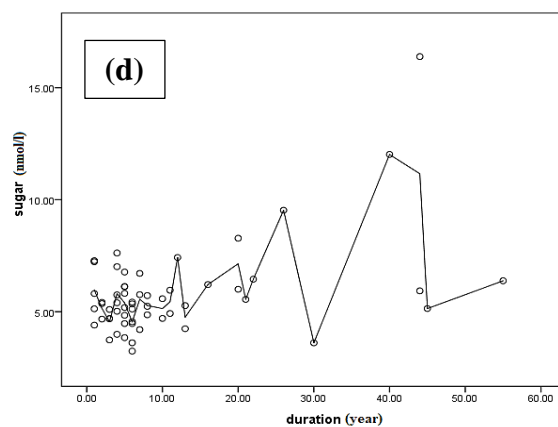
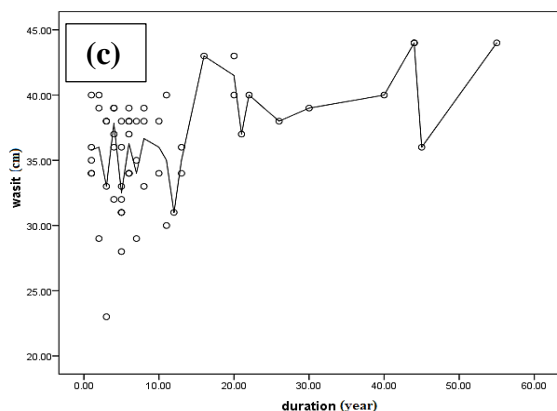
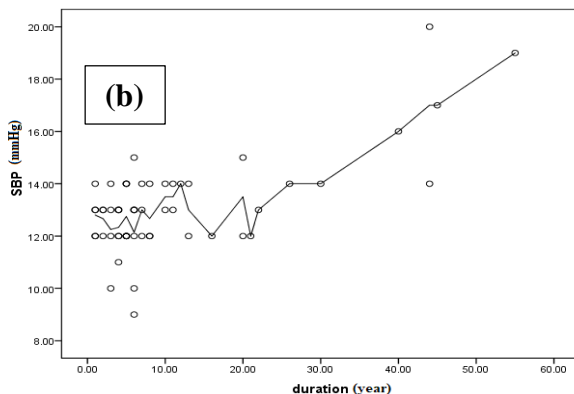
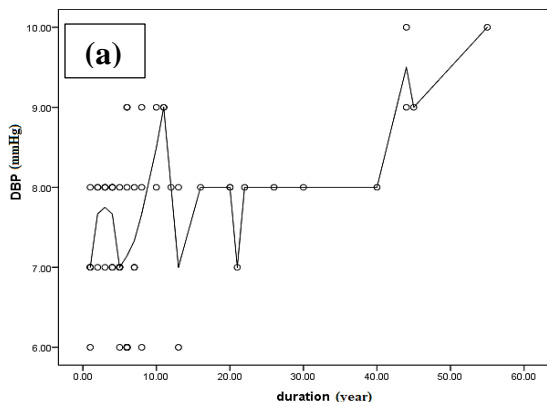
**Table (3): Effect of smoking duration increasing on SHBG level**

Gp duration	N	Mean $\pm$ SE	Sig < 0.05
1	12	78.20 $\pm$ 12.81	0.04
2	21	86.24 $\pm$ 6.90	
2	21	86.26 $\pm$ 6.90	0.26
3	23	86.21 $\pm$ 8.84	
1	12	78.20 $\pm$ 12.81	0.45
3	23	86.21 $\pm$ 8.84	

\* Significant differences ( $p \leq 0.05$ ).

**Table (4): Pearson's correlation coefficients for the relationships Fasting blood glucose with number of cigarettes, smoking duration and waist circumference).**

Parameters	Fasting blood glucose	
Number of cigarettes	r	0.35**
	Sig	0.006
	N	57
Duration (year)	r	0.48**
	Sig	0.00
	N	57
Waist (cm)	r	0.34**
	Sig	0.008
	N	57



**Figure (1): a, b, c, d describe the effect of increasing duration of smoking on some vital measures as DBP, SBP, WC and glucose) respectively and shown increasing of all the mentioned indicators**

### 3. Discussion:

With the increase the phenomenon of smoking and the spread of several types of it, several studies indicated the role of nicotine in the disruption of some hormones and its effect on the metabolism process in many different parts of the world.

The current study sheds light on the effect of smoking on reproductive system disorder and the sex hormone binding globulin (SHBG). We clarified the relationship of the SHBG hormone with smoking in adults Iraqi men, as showing in table (2) the statistically high levels of SHBG hormone in the smoking men when compare those with control (who never smoke any cigarettes),  $p$  value  $< 0.05$ , this increase is related to the high level of nicotine in the blood 13,14. While the effect of the nicotine on testosterone still vague, due to the difference in hormone levels during one day from the peak (6.00-8.00) H to the lowest level (1800-2000) H 15. Some theories adopted an increase in the hormone, they have been assumed that the increase in testosterone is related to the increasing in the SHBG hormone, whereas some theories suggested a decline in the hormone for smokers caused by nicotine effect on leydig cell, decreasing of hormone found that smoking is directly related to steroid formation and also affects the enzymatic activities. Cigarette components act as competitive inhibitors of 3 alpha-hydroxysteroid dehydrogenase which is an enzyme (converting dihydrotestosterone to 3 alpha-androstadiol 16. Several studies were conducted to measure the levels of reproductive hormones in smokers, where the results were conflicted, this is due to the difference in ethnicity, genes and the different activities of donors from one place to another around

the world. At variance the current study, our data shows there are no significant differences in testosterone level in both groups, these results agree with Haik et al 17.

Table (3) gave an assessment for SHBG hormone level for smokers only, based on the increasing of smoking duration in years, the moral increase was limited only in the first year of smoking age, then this increase recedes with the progression of the smoking years, these results agree with Elmleeh and Abdrabo 18, which deals the correlation of testosterone level with increasing of smoking duration, considering the testosterone and SHBG, both are within the same reproductive system. Testosterone is also affected by the same changes that occur in SHBG, where SHBG has a high affinity with testosterone and considering a major distributor whether free or bound 19.

High blood pressure and high blood sugar are among the most common problems in the Middle 20. The relationship between sugar and smoking has been indicated by many studies, where there was a contradiction in the results. The current study showed no statistical differences in the blood sugar level for smokers compared to non-smokers as shown in table (1). This is due to the effect of nicotine on loss of appetite and weight stability for smokers compared to non-smokers 21. High levels of nicotine, over time in the body have a direct effect on the activity of  $\beta$  cells in the pancreas, causing glycaemia 22 23, this is agreeing with our data, as shown in table (4) (Smokers only).

Kim et al 24 point to the Smokers tend to have a higher accumulation abdominal fat, subsequently raise waist circumference, agree with current study as shown in figure (1-c), while BMI is still constant, increased WC is an indicator of increased insulin resistance. Previous studies 25, 26, 27 proved consuming a cigarette every day leads to an increase in waist circumference by an average of 0.14% while maintaining a constant weight these results are in agreement with the current study as shown in table (1) no a differences mean in BMI between smokers and nonsmokers. On the other hand, several studies have shown a decrease in BMI in smokers due to the effect of nicotine in metabolic disorder and its effectiveness in curbing appetite 28, 29.

The phenomenon of smoking and hypertension is one of the syndromes terms, the body's response to this effect is appears in the long run, 4 to 5 million people per year are exposed to sudden death due to smoking 30. Some limited studies have not shown any correlations between smoking and hypertension 31. This does not agree with our results, as the current study showed an increase in both diastolic and systolic blood pressures with the increase in smoking duration (continuous smoking) as shown in figure (A and B). Smoking leads to disruption of the lining of the blood

vessels, atherosclerosis, endothelial dysfunction and chronic heart disease. Smoking also increases the secretion of sympathetic neurotransmitters associated with the dynamics of metabolic changes 32. The blood pressure rises due to the resistance of the total peripheral vessels and cardiac output 33. Recorded that the consumption of each cigarette had a significant and a sharp increase in blood pressure, it can be determined by the pressure gauge and monitored within 24 hours.

#### 4. Conclusion:

High levels of SHBG hormone in smokers compared to control, as well as an increased tendency to develop diabetes, coinciding with a high waist circumference of smokers when compared to healthy men.

#### 5. Conflicts of interest:

No Conflicts of interest

#### 6. Formatting of funding sources

Self

#### 7. Acknowledgment:

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