



## Effect of smoking on glycosylated hemoglobin (HbA<sub>1c</sub>) among patients with diabetes mellitus type II

Dr. REDHA A. H. AL-HASHIMI  
M.B. Ch.B., F.I.B.M.S; Department of Medicine  
College of Medicine, University of Missan  
Missan, Iraq

### Abstract:

*Smoking in patients with diabetes was widespread. The level of HbA<sub>1c</sub> correlated well with the glycemic control over a period of 2 to 3 months, leading to the gradual incorporation of the test into clinical practice. Aim of the study is to study associations between smoking and glycemic control as reflected by HbA<sub>1c</sub>. A cross- sectional study aimed to study the associations between smoking and glycemic control as reflected by HbA<sub>1c</sub> with an analytic element. This study was performed by participating 160 diabetic patients whom attended the diabetes center in Al-Amarah city, during the period from September, 2014 to April 2015. HbA<sub>1c</sub> <7% (<53 mmol/mol) in adults consider a target value. This study was show that higher percent of smoking were in middle age group (40-54 years) diabetic patients. There was a high prevalence of smoking among male patients with DM. The conclusion was a significant association (*P* value < 0.05) between smoking and poor glycemic control in type II diabetic patients in compare with those nonsmokers diabetics.*

**Key words:** DM, HbA<sub>1c</sub>, Smoking, Glycated hemoglobin, Missan

### 1. Introduction

Smoking is one of the modifiable risk factors for many chronic diseases, such as cardiovascular disease (CVD), cancer, chronic

obstructive lung disease, asthma and diabetes mellitus (DM). However, the adverse effects of smoking on diabetes have been generally under recognized. In the guidelines from the Korean Diabetes Association, smoking cessation is recommended as one of the most important steps in preventing the cardiovascular complications of diabetes (1). Many studies have shown that the adverse effects of smoking on diabetes mellitus are not only diabetic macrovascular complications but the causal nature of its association with diabetes and the progression of diabetic microvascular complications has yet to be explored. Although smoking is known to decrease body weight, it is associated with central obesity (2). Smoking also increases inflammation and oxidative stress (3), to directly damage  $\beta$ -cell function (4) and to impair endothelial function (5).

The exact mechanism for why smoking increases the risk of DM and deteriorates glucose homeostasis has not been fully elucidated, but the available evidence shows that smoking increases insulin resistance. In healthy young men, acute smoking showed an increased insulin resistance (6). Smokers had a significantly increased homeostatic model assessment insulin resistance index an hour after smoking (7). Thus smoking induced insulin resistance in patients with type II diabetes, as well as healthy subjects. In terms of glucose homeostasis, smoking has a negative effect on glucose control. In a population-based prospective study, cigarette smoking was positively associated in a dose dependent manner with elevated HbA<sub>1c</sub> after adjustment for possible confounding by dietary variables (8). This finding was also reported in patients with diabetes in Sweden; smoking type I and type II patients had a higher mean HbA<sub>1c</sub> but a lower mean body mass index than non-smokers (9). Smoking in patients with diabetes was widespread, especially in young female type I, and in middle-aged type I and type II diabetes patients (10).

The American Diabetes Association (ADA) recommend a target values for HbA<sub>1c</sub> in relation to age as follows: HbA<sub>1c</sub>

<8.5% (<69 mmol/mol) at age <6 years, <8 (<64 mmol/mol) % at 6 to 12 years, <7.5% (<58 mmol/mol) at 13 to 18 years and <7% (<53 mmol/mol) in adults (11). Glycated hemoglobin (HbA<sub>1c</sub>) was first described by Rahbar in 1969 (12). Subsequent studies showed that the level of HbA<sub>1c</sub> correlated well with the glycemic control over a period of 2 to 3 months, leading to the gradual incorporation of the test into clinical practice in the 1980s (13). With the publication of the Diabetes Control and Complications Trial (14) and the United Kingdom Prospective Diabetes Study (15), both of which correlated the HbA<sub>1c</sub> levels to the development of diabetes complications, HbA<sub>1c</sub> estimation has become established as a cornerstone of diabetes management.

## 2. Patients & Methods

The study was a cross- sectional study with an analytic element. This study was performed by participating 160 diabetic patients whom attended the diabetes center in Al-Amarah city; during the period from September, 2014 to April 2015. They were allocated into two groups:

- 1- First group: includes DM patients and smokers.
- 2- Second group: includes DM patients and non-smokers.

HbA<sub>1c</sub> <7% (<53 mmol/mol) in adults consider a target values (ADA) recommendations. Data was collected using a special formula, constructed by the researcher and based on the standard criteria. The information include name, age, gender, duration of disease and type of medication use. The study protocol was reviewed; approval and official permission were obtained from the Ministry of Higher Education to conduct the present study.

### 3. Results

The study shows that the prevalence of smoking was high (51 %) among age groups (45-54 yr) of diabetics than other age group, table 1.

**Table 1. The relation between DM patients (smoking and nonsmoking) and age groups**

Age (yrs)	DM						P value	
	Smoking		Non-smoking		Total			
	No.	%	No.	%	No.	%		
35 -44	16	20.2	17	21.25	33	20		
45-54	41	51	37	46.25	78	49		
55+	23	28.8	26	32.5	49	31		
Total	80	50	80	50	160	100		

Regarding gender, the study show thesmoking was higheramong males than female (88% and 12% respectively) with significant association, as showing in table 2 below.

**Table 2. The relation between DM patients (smoking and nonsmoking) and gender**

Gender	DM						P value	
	Smoking		Non smoking		Total			
	No.	%	No.	%	No.	%		
Male	70	88	13	16	83	52		
Female	10	12	67	84	77	48		
Total	80	50	80	50	160	100		

The table below shows the distribution of smoking among diabetics in relation to the duration of their disease which was higher in those with duration less than 5 years (69% in compare with those more than 5 years 31%).

**Table. 3. The relation between DM patients (smoking and nonsmoking) and duration of disease**

Duration of disease (yrs)	DM						P value	
	Smoking		Non smoking		Total			
	No.	%	No.	%	No.	%		
Less than 5	55	69	22	27	77	48		
More than 5	25	31	58	73	83	52		
Total	80	50	80	50	160	100		

Our study show the higher incidence of poor glycemic control as reflected by HbA<sub>1c</sub> > 7 among diabetics with smoking (87.5%) in comparison with those with good control HbA<sub>1c</sub> 5-7 (12.5%), see table 4.

**Table 4. The relation between DM patients (smoking and nonsmoking) and level of HbA<sub>1c</sub>**

HbA <sub>1c</sub>	DM						P value 0.04	
	Smoking		Non smoking		Total			
	No.	%	No.	%	No.	%		
5-7	10	12.5	20	25	30	18.7		
>7	70	87.5	60	75	130	81.3		
Total	80	50	80	50	160	100		

Also the present study show the relation between use of insulin in type II DM and smoking,in which percentage of patients use insulin in comparison with OHD (oral hypoglycemic drugs) and patients use OHD alone is (25% versus 75%), with significant association, as showing in table 5 below.

**Table. 5. The relation between DM patients (smoking and nonsmoking) and type of medication**

Medication	DM						P value 0.008	
	Smoker		Non smoker		Total			
	Freq.	%	Freq.	%	Freq.	%		
OHD	60	75	44	73	104	65		
Both	20	25	36	27	56	35		
Total	80	50	80	50	160	100		

## Discussion

Smoking in patients with diabetes was widespread. This study show that higher percent of smoking were in middle age group (40-54 years) diabetic patients were about 55% and this met other studies as Nilssona, in study which state that smoking is higher in middle-aged type I and type II diabetes patients (10).

In this study, there is high prevalence of smoking among male patients with DM ( 88%, 12%) respectively and this doesn't goes with other studies which show high prevalence in young female type I, and in middle-aged type 1 and type II diabetes patients (10).

This study shows a significant association (P value < 0.05) between smoking and poor glycemic control in type 2 diabetic patients in compare with those nonsmokers diabetics (12.5%, 18.7% in good control in smoker and nonsmoker diabetics respectively and 87.5%,81.3% in poorly control diabetics in both respectively) and this compatible with fact that cigarette smoking was positively associated in a dose dependent manner with elevated HbA<sub>1c</sub> after adjustment for possible confounding by dietary variables (8) and this finding was also reported in patients with diabetes in Sweden; smoking type I and type II patients had a higher mean HbA<sub>1c</sub> (9).

While previous studies had shown smoking increases HbA<sub>1c</sub> levels, Nicotine levels similar to those found in the blood of smokers increased HbA<sub>1c</sub> levels by as much as 34 percent.

## 5. Conclusion

This study show a significant association between smoking and poor glycemic control in type II diabetic patients in compare with those nonsmokers diabetics.

Further studies are needed to evaluate the effect of type of treatment whether insulin, OHDs, or both with smoking on glycemic control.

## REFERENCES

1. Ko SH, Kim SR, Kim DJ, Oh SJ, Lee HJ, Shim KH, Woo MH, Kim JY, Kim NH, Kim JT, Kim CH, Kim HJ, Jeong IK, Hong EK, Cho JH, Mok JO, Yoon KH. Committee of

- Clinical Practice Guidelines, Korean Diabetes Association. 2011 Clinical practice guidelines for type 2 diabetes in Korea. *Diabetes Metab J.* 35:431–436, 2011.
2. Canoy D, Wareham N, Luben R, Welch A, Bingham S, Day N, Khaw KT. Cigarette smoking and fat distribution in 21,828 British men and women: a population-based study. *Obesity Research*, 13(8): 1466–1475, 2005.
  3. Morrow JD, Frei B, Longmire AW, Gaziano JM, Lynch SM, Shyr Y, Strauss WE, Oates JA, Roberts LJ., 2nd Increase in circulating products of lipid peroxidation (F2-isoprostanes) in smokers: smoking as a cause of oxidative damage. *New England Journal of Medicine*. 332:1198–1203, 1995.
  4. Spector TD, Blake DR. Effect of cigarette smoking on Langerhans' cells. *Lancet*. 2:1028, 1988.
  5. Noma K, Goto C, Nishioka K, Hara K, Kimura M, Umemura T, Jitsuiki D, Nakagawa K, Oshima T, Chayama K, Yoshizumi M, Higashi Y. Smoking, endothelial function, and Rho-kinase in humans. *Arteriosclerosis Thrombosis and Vascular Biology*. 25:2630–2635, 2005.
  6. Attvall S, Fowelin J, Lager I, Von Schenck H, Smith U. Smoking induces insulin resistance: a potential link with the insulin resistance syndrome. *Journal of Internal Medicine*. 233:327–332, 1993.
  7. Seet RC, Loke WM, Khoo CM, Chew SE, Chong WL, Quek AM, Lim EC, Halliwell B. Acute effects of cigarette smoking on insulin resistance and arterial stiffness in young adults. *Atherosclerosis*. 224:195–200, 2012.
  8. Targher G, Alberiche M, Zenere MB, Bonadonna RC, Muggeo M, Bonora E. Cigarette smoking and insulin resistance in patients with noninsulin-dependent diabetes mellitus. *Journal of Clinical Endocrinology and Metabolism*. 82:3619–3624, 1997.

9. Eliasson B, Attvall S, Taskinen MR, Smith U. The insulin resistance syndrome in smokers is related to smoking habits. *Arteriosclerosis and thrombosis journal*, 14(12): 1946-1950, 1994.
10. Nilsson PM, Gudbjornsdottir S, Eliasson B, Cederholm J: Smoking is associated with increased HbA1c values and microalbuminuria in patients with diabetes: Data from the National Diabetes Register in Sweden. *Diabetes Metabolism*. 30(3): 261–268, 2004.