



# Research Paper

## Influence of Demographic and Lifestyle Factors on Diabetes Control in Iraqi Patients

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## ABSTRACT

**Background:** A serious public health issue in Iraq is diabetes mellitus (DM), which is becoming more common due to demographic and lifestyle factors. The purpose of this research is to examine the association between smoking behaviors, body mass index (BMI), and age in Iraqi patients with diabetes mellitus.

**Methods:** A cross-sectional study was conducted at the National Diabetes Center, Al-Mustansiriya University, between September and December 2016. A total of 300 diabetic patients aged 30–84 years were enrolled and classified into five groups based on age and gender. Fasting blood glucose (FBG), glycated hemoglobin (HbA1c), body mass index (BMI), and daily cigarette consumption were measured.

**Results:** Among patients aged 50–59, males had the highest mean FBG ( $462.0 \pm 96.3$  mg/dl) and BMI ( $35.7 \pm 29.4$  kg/m<sup>2</sup>). Across all age groups, female patients' BMI remained elevated, and patients aged 50–69 years had the highest HbA1c readings. Male and female patients showed the *most significant* positive relationships between FBG and HbA1c ( $r = 0.631$  in Group E). There was little correlation between smoking and FBG, except for a moderately positive correlation in middle-aged women, and a weak and erratic correlation between BMI and FBG.

**Conclusion:** In Iraqi diabetic patients, age and BMI have a *significant* impact on glycemic control, especially in middle-aged people. Poor glycemic control is more consistently associated with BMI in female patients. In some subgroups, smoking may exacerbate glycemic indices, although its impact seems to be limited. It is advised to implement focused weight-control and smoking cessation strategies to improve diabetes outcomes.

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## Introduction

**D**iabetes mellitus (DM) is a complicated, long-term condition that necessitates ongoing medical attention as well as patient self-management to lower the risk of long-term consequences and avoid acute ones. Type 2 diabetes mellitus (T2DM), characterized by insulin resistance and relative insulin deficiency, and type 1 diabetes mellitus (T1DM), caused by the autoimmune destruction of pancreatic  $\beta$ -cells, are the two main categories. Over 90% of all instances of diabetes are type 2 diabetes, which is becoming more common in both developed and developing countries [1, 2]. The World Health Organization (WHO) reports that the number of persons with diabetes has increased significantly over the past few decades, with low- and middle-income nations seeing the most increase. Urbanization, sedentary lifestyles, dietary changes, rising obesity rates, and smoking are some of the causes contributing to the alarming increase in diabetes incidence in Iraq. According to recent national studies, the prevalence of diabetes in Iraq varies by area and diagnostic criteria, ranging from 8% to 13% [3].

Numerous behavioral and demographic factors have been linked to the onset and inadequate management of diabetes mellitus. Age is a significant risk factor that cannot be changed; as people age, they are more likely to develop insulin resistance and  $\beta$ -cell malfunction, which can cause type 2 diabetes to develop or worsen. Moreover, altered glucose control may be exacerbated by age-related changes in body composition and physical activity [4-6]. Body mass index (BMI), which is frequently used to measure obesity, is a well-known modifiable risk factor for the onset and inadequate management of diabetes. Insulin resistance, systemic inflammation, and metabolic dysregulation are associated with excess adipose tissue, particularly visceral fat. Poor long-term glycemic management is indicated by a high BMI, which is strongly associated with elevated fasting glucose and HbA1c [7, 8].

Smoking, which has been demonstrated to raise the risk of type 2 diabetes and worsen glycemic dysregulation in diabetics, is another significant lifestyle component. Through intricate biochemical processes, nicotine and other harmful substances in cigarettes reduce insulin sensitivity, encourage central obesity, and may change how glucose is metabolized. Despite this, smoking is still rather prevalent among various Iraqi groups, including those who have diabetes [9-11]. Understanding how these variables—age, BMI, and smoking—interact with glycemic control parameters such as fasting blood glucose (FBG) and glycated

hemoglobin (HbA1c) is crucial for effective diabetes management.

## Materials and Methods

### Study Design

This cross-sectional study was conducted at the Outpatient Clinic of the National Diabetes Center, affiliated with Al-Mustansiriya University, Baghdad, Iraq. The data collection took place over four months, from September to December 2016, confirmed by medical records. Type 1 diabetes patients and gestational diabetes cases were excluded from the study. Diagnosis guidelines and laboratory results adhered to the standards of the Iraqi Ministry of Health. Type 2 diabetes was defined as the inability to secrete insulin, combined with poor insulin utilization. Patients had to be Iraqi, older than 18 years, and under treatment with either oral hypoglycemic drugs or insulin.

### Study Population

A total of 300 patients diagnosed with diabetes mellitus were included in the study. These patients were attending routine follow-up visits at the diabetes center during the study period.

### Sample Size

The sample size is calculated using the Raosoft® online calculator. A 92% confidence level and a 5% margin of error were applied in the calculation. Data collection was concluded once the target number of responses was achieved. Based on these criteria, a sample size of 300 participants was deemed appropriate.

### Inclusion Criteria

Patients of both sexes aged thirty to eighty-four were identified as having type 2 diabetes.

### Exclusion Criteria

Patients with type 1 diabetes mellitus, pregnant women, patients with known endocrine disorders or severe chronic illnesses (e.g., cancer, renal failure), and those with incomplete clinical or laboratory data.

### Data Collection and Parameters Measured

For each participant, the following information was gathered: After 8–10 hours of fasting, fasting blood glucose (FBG) was measured in milligrams per deciliter (mg/dL).

High-performance liquid chromatography (HPLC) is used to quantify glycated hemoglobin (HbA1c), which is expressed as a percentage (%).

Body Mass Index (BMI): Determined by applying the following formula:

Patients were weighed using a calibrated scale, and height was measured

Smoking Status: Quantified by the average number of cigarettes smoked per day, based on patient self-report.

### Statistical Analysis

Microsoft Excel 2021 and SPSS version 15.01 were used to analyze the data. The following statistical methods were used: Clinical and demographic data were summarized using descriptive statistics and displayed as mean ± standard deviation.

For categorical variables and to investigate correlations in contingency tables, the chi-square test ( $\chi^2$ ) was employed. The t-test for independent samples was used to compare group means. The direction and strength of the correlations among the variables under investigation were assessed using the Pearson correlation coefficient (r). For every test, a p-value of less than 0.05 was deemed statistically significant.

## Results

### Patient Distribution

A total of 300 patients with type 2 diabetes mellitus were included in the study. They were divided into male and female groups, each further stratified into five age categories: Group A: 30–39 years; Group B: 40–49 years; Group C: 50–59 years; Group D: 60–69 years;

**Table 1.** Mean ± SD values of fasting blood glucose (FBG), HbA1c, BMI, and daily cigarette consumption among male patients.

Group3	Fasting Blood Glucose (mg/dL)	HbA1c (%)	BMI (kg/m <sup>2</sup> )	Cigarettes/day
A	202.13 ± 119.01	10.08 ± 3.18	25.16 ± 2.84	7.00±4.45
B	236.71 ± 87.28	9.67 ± 1.87	30.13 ± 3.43	7.63±4.58
C	462.00 ± 96.34	8.60 ± 5.86	35.70 ± 29.41	9.83±8.69
D	190.14 ± 59.87	7.74 ± 1.32	29.16 ± 4.75	11.86±10.99
E	178.58 ± 61.58	8.63 ± 2.20	27.48 ± 4.61	9.08±7.91

Group E: 70–84 years. Table 1 shows the mean ± SD values of fasting blood glucose (FBG), HbA1c, BMI, and daily cigarette consumption among male patients. The highest mean FBG level (462.0 ± 96.3 mg/dl) was observed in Group C (50–59 years), accompanied by the highest BMI (35.7 ± 29.4 kg/m<sup>2</sup>). HbA1c values ranged from 7.74% in Group D to 10.08% Group A. Daily cigarette consumption was highest in Group D (11.86 ± 10.99) cigarettes/day.

Table 2 presents the same parameters for female patients. FBG values were relatively consistent across groups, ranging from 200.4 ± 65.4 mg/dl in Group B to 236.6 ± 84.6 mg/dl in Groups C and D. HbA1c was highest in Group C and D (9.69%), and BMI peaked in Group C (32.77 ± 5.59 kg/m). Daily cigarette consumption was generally lower in females than in males, ranging from 4 ± 1 cigarettes/day in Group A to 10 ± 3 cigarettes/day in Group D.

Table 3 summarizes the Pearson correlation coefficients for FBG, HbA1c, BMI, and cigarette smoking in male patients. Positive correlations were observed between FBG and HbA1c across all age groups, with the strongest in Groups A (r = 0.677) and D (r = 0.519). Weak or negative correlations were noted between FBG and BMI, especially in Group A (r = -0.245). Smoking showed inconsistent correlation with FBG: positive in Group D (r = 0.204) and negative in Groups A and C.

Table 4 shows the correlation coefficients for female patients: Stronger positive correlations between FBG and HbA1c were observed than in males, particularly in Group E (r = 0.631) and Group C (r = 0.557). BMI showed a positive correlation with FBG in younger groups (e.g., Group A: r = 0.545), but a weak or negative correlation in older groups. Smoking showed no consistent pattern, with a slight positive

**Table 2.** Mean ± SD values of fasting blood glucose (FBG), HbA1c, BMI, and daily cigarette consumption among female patients.

Group	Fasting Blood Glucose (mg/dL)	HbA1c (%)	BMI (kg/m <sup>2</sup> )	Cigarettes/day
A	231.6 ± 53.38	9.75 ± 1.48	27.62 ± 4.01	4 ± 1
B	200.40 ± 65.43	9.03 ± 1.91	32.50 ± 5.61	5 ± 3
C	236.62 ± 84.64	9.69 ± 1.99	32.77 ± 5.59	10 ± 1
D	236.62 ± 84.64	9.69 ± 1.99	32.77 ± 5.59	10 ± 3
E	229.38 ± 92.91	9.13 ± 1.83	30.79 ± 5.83	8 ± 2

**Table 3.** Pearson correlation coefficients in male patients.

Group	HbA1c (%)	BMI (kg/m <sup>2</sup> )	Cigarettes/day
A	0.677	-0.245	-0.371
B	0.419	-0.056	0.074
C	0.380	0.204	-0.199
D	0.519	-0.043	0.204
E	0.434	-0.120	-0.177

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**Table 4.** Pearson correlation coefficients in female patients.

Group	HbA1c (%)	BMI (kg/m <sup>2</sup> )	Cigarettes/day
A	0.504	0.545	0.000
B	0.524	-0.165	0.093
C	0.557	0.136	0.557
D	0.557	0.136	-0.143
E	0.631	0.099	-0.174

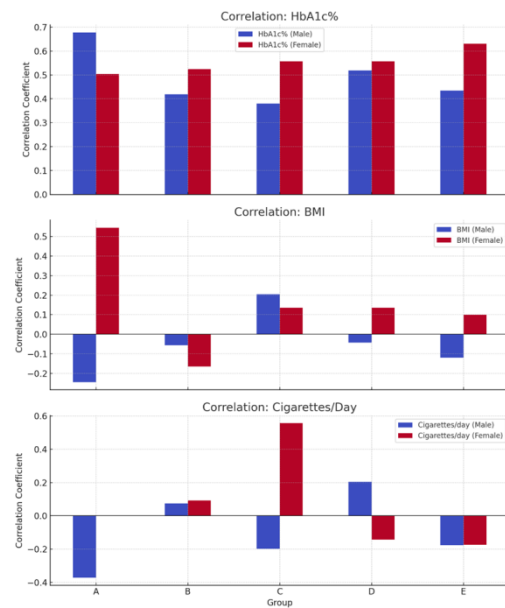
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correlation in Group C ( $r = 0.557$ ) and negative values in Groups D and E.

Comparing correlation coefficients for male and female groups (A–E) across three parameters is shown in Figure 1.

### Discussion

The findings revealed significant associations between glycemic control and several clinical factors. Poor glycemic control was more prevalent among smokers, individuals with higher BMI, and older patients. Additionally, both HbA1c and fasting blood glucose levels showed notable variation across age and sex subgroups, showing that glycemic control varied with age. FBG levels in female patients were comparatively constant across age groups, whereas in male patients, FBG peaked in the 50–59 years group (Group C). These results imply that, particularly for men, midlife may be a crucial time for glycemic instability. These developments may be caused by



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**Figure 1.** Comparison between male and female.

changes in body composition, age-related insulin resistance, and lifestyle factors, including reduced physical exercise [12]. Furthermore, FBG and HbA1c readings, which represent the average blood glucose during the preceding two to three months, showed a favorable correlation in almost every age category for both sexes. According to the literature, HbA1c is a good predictor of long-term glycemic control and tends to increase with age due to deteriorating metabolic dysfunction [13].

BMI exhibited varying associations with glycemic control across different age groups. Among female patients, higher BMI values were generally found in the middle-aged groups (Groups B–D), with modest positive correlations between BMI and FBG in certain subgroups (e.g., Group A:  $r = 0.545$ ). This supports previous findings that obesity, particularly in women, is a significant risk factor for insulin resistance and poor glycemic control. However, in several male age groups, BMI and fasting blood glucose (FBG) showed weak or even negative correlations (e.g., Group A:  $r = -0.245$ ; Group B:  $r = -0.056$ ). These results may be influenced by confounding factors such as lean body mass, lifestyle factors not captured in this study, or differences in fat distribution (visceral vs. subcutaneous). Additionally, these associations might be affected by the possibility that male patients with higher BMI were already receiving more intensive diabetic treatment [14].

The role of cigarette smoking in glycemic control remains controversial. In this study, smoking (measured as the number of cigarettes per day) showed inconsistent and weak correlations with FBG. While

some groups showed positive associations (e.g., male Group D:  $r = 0.204$ ; female Group C:  $r = 0.557$ ), others showed negative or no correlation at all. Variations in smoking intensity, length (pack-years), or concomitant risk variables like stress and diet could account for these contradictory results. Furthermore, the data's generalizability is limited by the small percentage of heavy smokers, particularly among female patients. However, considering the well-known metabolic effects of nicotine, including reduced insulin sensitivity and increased central adiposity, smoking cessation should be an integral part of diabetes treatment plans [15, 16].

The study also identified sex-specific tendencies. Across all age groups, female patients' BMIs were typically higher than those of male patients. Despite this, females showed more consistent associations between BMI and FBG than males did. The more variable FBG values in male subgroups, on the other hand, might be partially explained by the fact that men consumed more cigarettes on average. Men and women may respond differently to metabolic stressors and treatment measures, underscoring the importance of gender-sensitive approaches in diabetes management [17, 18].

## Conclusion

Age and HbA1c were consistently positively correlated with fasting glucose, confirming their significance as key markers for diabetes monitoring. Smoking and BMI showed weaker, less consistent associations, suggesting that other clinical or lifestyle factors may influence their effects. To confirm these findings and explore the impact of additional factors such as dietary habits, medication adherence, and physical activity on glycemic control in this population, further multicenter longitudinal studies are recommended.

## Acknowledgment

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## Ethical Approval

The research proposal describes the goals of the current study, and the proposed data collection techniques were administered to the "College of Pharmacy, AL-Nahrain University," and approval was obtained from the Scientific and Ethical Committee (approval name: nah.co.pha.H5).

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## Conflicts of Interest

The authors report there are no competing interests to declare.

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