



Article

Prevalence of Undiagnosed D.M and Prediabetic Patients in Iraq

Asmaa Ameen Ghareeb¹, Hayder Ali Saeed², Fouad Kader Abdullah³

1. B.Sc. in Medical Laboratory Techniques, Kirkuk Health Directorate, Kirkuk First Sector, Kirkuk, Iraq

2. B.Sc. in Chemistry, Diyala Health Directorate, Baqubah Teaching Hospital, Diyala, Iraq

3. M.Sc. in Microbiology, Kirkuk Health Directorate, Kirkuk First Sector, Kirkuk, Iraq

Correspondance: asmaababani@gmail.com¹, hayder.dihm20@epu.edu.iq², fuad70kader@gmail.com³

Abstract: Undiagnosed diabetes mellitus (DM) and prediabetes are important public health issues. This study analyzed the prevalence among Iraqi adults and their association with age, sex, and BMI. This study included 100 adult participants from Kirkuk- Iraq. Their diabetes status was identified based on the results of HbA1c test as normal (<5.7%), prediabetes (5.7-6.4%), or diabetes which are above (6.5%). Data was analyzed using Kruskal-Wallis tests and multinomial logistic regression. Results is 69% of the participants were normal diabetic status HbA1c > 5.7%, while 25% had prediabetes and 6% had a diabetic range of HbA1c. BMI, RBS, HbA1c, and insulin was different significantly between groups. Regression analysis showed an association between prediabetes participants and RBS (OR=1.06, P=0.007). while insulin was associated with prediabetes (OR=1.47, p<0.001). Prediabetes and diabetic participants were present in the studies population, RBS and insulin showed a significant relation with diabetic status.

Keywords: Diabetes Mellitus, Prediabetes, HbA1c, BMI, RBS, Prevalence

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1. Introduction

Diabetes Mellitus (DM) is a spread non communicable disease which has more than one type, Type 1 diabetes which affects children and its genetic related disease[1]. Type 2 diabetes affects adults, especially aged above 30 years old[2], while gestational diabetes occurs through the gestational period during pregnancy[3]. All types of DM result from impaired insulin secretion, insulin intolerance, or both[4]. Its also associated with microvascular and macrovascular complications[5]. The reason that makes DM is significant [6] because it can remain asymptomatic for long periods which give the space for serious metabolic complications to happen.

Before being a diabetic patient there is a stage representing a border line between normal and high abnormal HbA1c results, this period is detectable, and if discovered early can decrease the risk factors and complications of getting cardiovascular, kidney, liver disease that affects the individual health. There are several factors that affect the status of DM including (age, obesity, insulin resistance, and other metabolic abnormalities). According to the American Diabetes Association Criteria an HbA1c of 5.7-6.4 are considered prediabetic individual, while HbA1c > 6.5 considered as the range for diabetes diagnosis[7].

Un diagnosed DM is relevant in Iraq. Analysis of Iraq STEPS in 2015-Iraq involving 3853 adults aged > 18 years, reported an 8.1% prevalence of undiagnosed individuals with DM[8]. making this disease as one of the most important significant situations that must be controlled among Iraqi population. Therefore, this study aims to determine the prevalence of undiagnosed diabetes mellitus, measure the distribution according to age, sex, (BMI) and address the importance of early diagnosis can reduce future complications.

2. Materials and Methods

Study design

Cross sectional study was performed among population attending different laboratories in Kirkuk city- Iraq. During the period from May 2026 to July 2026. The total number of participants was 100, aged ≥ 18 years, they were randomly selected. The recorded data contains age, sex, body mass index (BMI), random blood sugar (RBS), HbA1c and serum insulin were included in this study.

Inclusion and exclusion criteria

Participant with symptoms of diabetes but undiagnosed diabetes status and age were > 30 years old were included. While pregnant women, diagnosed patients, participant who attend gym, and aged < 30 years were excluded.

Measurements of biochemistry test

BMI was measured by using the international equation and calculating by dividing the kilogram on high of the participant. RBS and HbA1c were measured using (Cobas 311, Roch, Germany) device, while the insulin was measured by serum in (E411 Cobas, Roch, Germany) device. The status of diabetes was divided into three groups based on the HbA1c results < 5.7 considered normal, while 5.7-6.4 considered as prediabetes, while > 6.5 considered as diabetic patients.

Statistical analysis

Jamovi programs were used for research data analysis[9]. Continuous variables were presented as median and IQR, while male, female, and status were presented as frequency and percentages. Shapiro-Wilk test applied for checking the distribution of data. Differences between the status were analyzed by using the Kruskal-Wallis test, with Dwass-Steel-Critchlow-Flinger (DSCF) post hoc comparison. Epsilon-squared (ϵ^2) was used to express the effect size. for analyzing the association between the variables and the diabetes status Multinomial logistic regression test was used. Results were presented as odd ratios and $p < 0.05$ were considered significantly important.

3. Results

Descriptive statistics showed that the Mean of Age, RBS, HbA1c, Insulin and BMI are (46.9, 121, 5.53, 13.0, 26.9) respectively. While Median and standard deviation of age (45.0 $\pm$ 17.1), RBS (115 $\pm$ 38.4), HbA1c (5.25 $\pm$ 0.94), insulin (12.6 $\pm$ 6.02) and BMI (26 $\pm$ 4.63). Shapiro-wilk test was applied to check the normality of the data distribution, the p value of (RBS, HbA1c, BMI, age and Insulin) was less than 0.001 (Table 1). For the gender distribution males were 51% and female were 49% and the normal status were 69%, prediabetes 25%, and undiagnosed diabetes 6% (Table 2).

Table 1. Shows descriptive analysis of Age, RBS, HbA1c, Insulin and BMI

Descriptives					
	Age	BMI	HbA1c	RBS	Insulin
Mean	46.9	26.9	5.53	121	13.0
Median	45.0	26.0	5.25	115	12.6

Standard deviation	17.1	4.63	0.949	38.4	6.02
IQR	33.5	5.00	1.00	31.0	6.67
Shapiro-Wilk W	0.934	0.945	0.768	0.776	0.953
Shapiro-Wilk p	<.001	<.001	<.001	<.001	0.001

Table 2 presents the p value of Kruskal-Wallis test of age, BMI, HbA1c, RBS, and insulin are (0.778, <0.001, <0.001, <0.001, <0.001, <0.001, and 0.001) respectively shows statistically significant differences between the diabetes status with RBS, HbA1c, BMI and insulin. While the effect size of Epsilon-squared test for age (0.00506), RBS (0.204), HbA1c (0.624), insulin (0.340), and BMI (0.153). Dwass-Steel-Critchlow-Fligner pairwise comparisons test for RBS was 0.005 in-between (prediabetes-normal), 0.002 in between (undiagnosed diabetes-normal), and 0.013 in between (prediabetes – undiagnosed diabetes), while for HbA1c the p value was <0.001 in between (normal-prediabetes and normal-undiagnosed diabetes) and 0.030 in between (prediabetes-undiagnosed diabetes), on the other hand DSCF test for insulin only in between (normal-prediabetes diabetes) showed a statistically significant p value <0.001, there was no statistically significance between (normal, prediabetes with undiagnosed diabetes). In addition, the p value of DSFC test for BMI was 0.004 in between (normal-prediabetes), 0.026 in between (normal-undiagnosed diabetes), and 0.22 between (prediabetes-undiagnosed diabetes). Furthermore, the p value of DSCF test for age showed no significance.

Table 2. Kruskal-Wallis test to differentiate the variants among the diabetes status.

Kruskal-Wallis			
	χ^2	df	p
Age	0.501	2	0.778
BMI	15.181	2	<.001
HbA1c	63.632	2	<.001
RBS	20.286	2	<.001
Insulin	33.700	2	<.001

Multinomial logistic regression test performed using diabetes status as the reference category, the model showed McFadden's pseudo- R^2 of 0.988, with deviance of 1.80 and an AIC of 25.8. For prediabetes-normal only insulin showed a statistical significance p-value = <0.001, OR= 1.47

Table 3. Multinomial Logistic Regression test in between (prediabetes-normal) and (undiagnosed diabetes- Normal).

Model Coefficients - Status						
Status	Predictor	Estimate	SE	Z	p	Odds ratio
Prediabetes - Normal	Intercept	-15.8250	3.9840	-3.9721	<.001	1.34e0-7
	Age	0.0142	0.0200	0.7090	0.478	1.01
	BMI	0.0902	0.0757	1.1907	0.234	1.09
	RBS	0.0536	0.0199	2.6900	0.007	1.06
	Insulin	0.3860	0.0985	3.9195	<.001	1.47
Undiagnosed Diabetes - Normal	Intercept	-28.6753	10.1912	-2.8137	0.005	3.52e-13
	Age	0.0489	0.0574	0.8515	0.394	1.05

BMI	0.1650	0.1994	0.8273	0.408	1.18
RBS	0.1362	0.0451	3.0176	0.003	1.15
Insulin	0.0213	0.2267	0.0939	0.925	1.02

4. Discussion

The presented study found that 25% of the groups studied were prediabetes and 6% were undiagnosed diabetes while 69% were healthy individuals. The undiagnosed diabetes wear near 8% that reported in the Iraqi survey of national STEPS[8]. And it was also reported in the community study in Zakho city which reported a lower percentage [10]. The variation in the percentages of undiagnosed diabetes may be due to the differences in the environment and the genetic background of different places in Iraq region. Furthermore, BMI showed a significant difference among diabetes group, the p values was <0.001, this result support the previous studies related to increased lipid level and HOMA-IR (insulin resistance) with the abnormal glucose level and metabolism [11, 12]. However, the reported levels of BMI in this study suggest that BMI was independent predictor after the adjustment of all variables together. In addition, there was a significant difference related with RBS between the groups the p value was < 0.001 which indicates an independent relationship between the studied groups (OR=1.06, p=0.007), while OR pf the undiagnosed diabetes was (0.015,p=0.003). similarly to some pervious studies that showed elevated RBS can identify induvial at high risk of undiagnosed diabetes [13, 14]. Insulin levels reported in this study were significantly related to prediabetes group (OR= 1.47, p= <0.001), this result may reflect an increased level of insulin during early stages of insulin resistance[15], while the age didn't show any significant association with diabetes status. HbA1c showed a statistically significant difference among diabetes status: However, this result is reasonable because HbA1c is already used as a predictors to identify the diabetic from healthy individuals therefor HbA1c was excluded from the regression model[16, 17]. Overall, the findings are simplifying the importance of early metabolic screening for identifications of prediabetes individuals to decrease the diabetes prevalence in Iraq especially for those who have high risk factors such increased BMI or obesity[18].

5. Conclusion

This study found that 25% of participants had prediabetes and 6% had undiagnosed diabetes, while 69% had normal HbA1c levels. Significant differences were observed in BMI, RBS, HbA1c, and insulin among diabetes-status groups. RBS was significantly associated with both prediabetes and undiagnosed diabetes, while insulin was significantly associated with prediabetes. These findings highlight the importance of early metabolic screening, particularly among individuals with elevated BMI or other risk factors, to identify prediabetes and undiagnosed diabetes and help reduce future diabetes-related complications in Iraq.

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