

Research Article

Obesity and poor glycemic control in patients with type 2 diabetes

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ABSTRACT

Background: Diabetic patients are extremely recommended to control their blood glucose levels below the standard targets. This study was aimed to evaluate the association between obesity status and poor glycemic control in these patients.

Methods: Type 2 diabetic outpatients (n=157) from a diabetes clinic in Ahvaz were recruited for the study. Patients who had insulin therapy were excluded from participants. Weight, height and BMI were recorded for each participant. Obesity status was defined by BMI. Glycosylated hemoglobin (HbA1c) was measured in fasting blood samples to estimate glycaemia status.

Results: Mean age of participants was 54.47 ± 9.39 years and mean BMI was 29.26 ± 5.04 kg/m². Poor glycemic control (HbA1c $\geq 7\%$) was observed in 63.7% of participants. The rate of poor glycemic control in obese group was 60.3% and there was no correlation between obesity and poor HbA1c control using logistic regression we found no association between obesity and poor glycemic control (OR=0.796; p=0.504). Obese patients had lower education level than non-obese patients (p=0.035). Females had higher poor glycemic control than males; however, it was not significant (62% vs. 50% in obese and 68.5% vs. 62.2% in non-obese groups).

Conclusions: More than half of participants had poor glycemic control. Obese patients had similar rate of hyperglycemia to non-obese ones. Lower educational level was contributed to obesity. Underlying risk factors for poor glycemic control status in diabetic patients are still unclear.

Keywords: BMI, Diabetes, Poor glycemic control, HbA1c, Obesity

INTRODUCTION

It has been estimated that 8.3% of world population suffer from diabetes and this will rise to more than 592 million persons by 2035.¹ Approximately 2 million adults in Iran has diabetes mellitus.² Type 2 diabetes is the most common form of diabetes.³ Type 2 diabetes mellitus is a key risk factor for cardiovascular disease.⁴ Health care professionals usually emphasize on HbA1C control for optimal diabetes management.⁵ The American Diabetes Association (ADA) recommends that diabetic patients should sustain their A1C levels below 7% to reduce the risk of micro-vascular and cardiovascular

complications.⁶⁻⁸ Previous studies have reported that about half of persons with diabetes were unsuccessful to reach the set target for HbA1C.⁹⁻¹¹ According to a study in 2008, 56% of Iranian type 2 diabetic patients had inappropriate HbA1C control.¹² HbA1C test provides a reliable estimation of average glycaemia over past three months and a strong prediction of diabetes complications.^{7,13,14}

People with impaired glucose levels and obesity are more prone for developing atherosclerosis. obesity plays a role in insulin resistance and hyperglycemia, and is an independent risk factor for cardiovascular events.¹⁵⁻¹⁷

Obesity and overweight rates are increasing in developing countries like Iran.^{18,19} Recently, it was estimated that 85.5 % of Iranian type 2 diabetes patients were obese.²⁰

To date, few studies have investigated the association between obesity status and hyperglycemia in patients with type 2 diabetes. This study tries to realize the possible relevance in this population.

METHODS

Participants

One hundred-fifty-seven type 2 diabetic adults (53 males and 104 females) 20 years-old or above (mean age: 54.46±9.39 years) with no insulin treatment were recruited from outpatients attending to diabetes clinic of Golestan Hospital, Ahvaz, Iran. Information about the study procedure and a written consent form were given to all participants before the beginning. The research protocol was complied with the Declaration of Helsinki and was affirmed by Ahvaz Jundishapur University of Medical Sciences Research Ethics Committee.

Biochemical assays

Boronate affinity assay was used to measure HbA1c in anticoagulated samples (Nycocard® HbA1c kit, AXIS SHIELD PoC AS, Norway) and HbA1c percentage was determined by color intensity measurement with Nycocard® READER II (Reference range: 4-15%, Norway).

Anthropometric data

Weight, height, body fat percentage and waist-circumference (WC) were measured in the morning before consuming anything. Weight and body fat percentage were measured using a digital scale without shoes (Omron Corp., Germany). Body mass index (BMI) was calculated by dividing weight by squared height (kg/m²). Physical activity level was evaluated using the short form of International Physical Activity Questionnaire as MET-hr/week.²¹

Participants were categorized into non-obese and obese groups using BMI. BMI less than 30 was considered as normal weight and BMI ≥30 was defined as obesity. HbA1c ≥7% was defined as poor glycemic control (hyperglycemia).⁵

Statistical analyses

Quantitative variables were reported as mean± standard deviation (SD), and categorical variables were presented as percentage. Chi-squared test was utilized for comparing categorical variables. Independent sample t-test (2-tailed) was used for evaluating quantitative variables in two categories. Association of quantitative

data was evaluated using Pearson correlation. All statistical analyses were performed using SPSS software (version 21.0; SPSS Inc., Chicago, IL, USA). P-values less than 0.05 were considered as significant.

RESULTS

Table 1: Participants' basic characteristics.

N=157	
Age (year)	54.47(9.39)
Male/Female (%)	33.8/ 66.2
BMI (Kg/m ²)	29.26(5.04)
PAL (MET-hour/week)	20.57(35.22)
Educational status (%)	
Higher education	32.5
Primary or secondary	45.2
Illiterate	22.3
HbA1c (%)	7.92(1.83)
OHA use (%)	
Yes	91.7
No	8.3

Values are presented as mean (SD) except for educational status and OHA use; BMI body mass index; PAL physical activity level; HbA1c glycosylated hemoglobin A1C; OHA oral hypoglycemic agents.

Totally, 53 males and 104 females were entered the study. The mean age of study participants was 54.46±9.39 years. Mean BMI was 27.32±3.80 kg/m² (Table 1). Out of patients, 91.7% had used oral hypoglycemic agent (OHA) (Table 1).

Mean BMI was 34.39 kg/m² in obese and 26.25 kg/m² in non-obese participants (p <0.001, Table 2). No difference was found among obese and non-obese patients for physical activity level (p=0.877, Table 2). Participants in obese and non-obese groups were of similar age groups (Mean age: 55.34 vs. 52.97 years; p=0.107, Table 2).

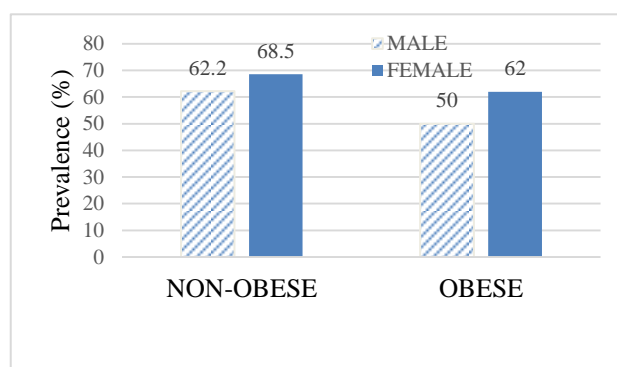


Figure 1: Poor glycemic control and obesity status.

Mean HbA1c level in subjects was 7.92%. Prevalence of poor glycemic control was 60.3% in obese and 65.7% in non-obese participants (p>0.05, Table 2). No correlation was found between obesity and HbA1c control (p>0.05). Logistic regression found no association between obesity

and having poor glyceemic control (CI: 0.407-1.555, OR=0.796; p=0.504).

Sex distribution was heterogeneous based on BMI category, with more females in obese group (86.2% vs. 13.8%; p<0.001, Table 2). Treatment with OHA was high in both obese and non-obese subjects (91.4% vs. 91.9%; p=0.555, Table 2). Most of patients had used a combination of OHA obese and non-obese group (Table 2).

There was a statistical difference in educational status of participants between two obesity groups. The proportion of subjects with diploma degree or above was higher in non-obese patients than that of obese group (p=0.035, Table 2).

Females had higher rates of hyperglycemia than males in obese (62% vs. 50%) and non-obese groups (68.5% vs. 62.2%), but no significant association was found between poor glyceemic control and obesity between the two genders (Figure 1).

Table 2: Characteristics of obese and non-obese participants.

	BMI <30 (N=99)	BMI ≥30 (N=58)	p-value
Age (year)	55.34 (10.00)	52.97 (8.10)	0.107
Male/Female (%)	45.5/54.5	13.8/86.2	<0.001*
BMI (Kg/m ²)	26.25 (2.52)	34.39 (4.00)	<0.001*
PAL (MET-hour/week)	20.24 (29.05)	21.14 (44.09)	0.877
Educational status (%)			0.035*
higher education	7.1	3.4	
diploma	31.3	19.0	
primary or secondary	36.4	60.3	
illiterate	25.3	17.2	
HbA1C (%)			
Good control	34.3	39.7	0.504
Poor control	65.7	60.3	
OHA (%)			
Metformin alone	27.3	36.2	
Sulfonylurea alone	5.1	5.2	
other	3.0	0.0	0.555
combined	56.6	50.0	
no drug	8.1	8.6	

Values are presented as mean (SD) except stated. * P<0.05 is significant; BMI body mass index; PAL physical activity level; HbA1c glycosylated hemoglobin A1C; OHA oral hypoglycemic agents.

DISCUSSION

Glyceemic control is a critical issue in clinical management of diabetes and its complications.⁵ It has been suggested that intensive glyceemic control is associated with lower prevalence of micro-vascular and neuropathic events in patients with type 2 diabetes mellitus.^{8,22,23} Also, significant reductions in albuminuria, myocardial infarction and all-cause mortality were observed by intensive glyceemic control in diabetics.²⁴⁻²⁶ National Health and Nutrition Examination Survey in 2001-2002 estimated that half of diabetic patients failed to achieve A1C goal.⁹ Current study revealed that 63.7% of persons with type 2 diabetes had poor glyceemic control that was higher than previous studies carried out in Iran and other parts of the world.^{9,11,12}

There was no relationship between obesity status by BMI and poor HbA1C control in type 2 diabetic subjects in this study. However, because of higher risk of death from cardiovascular disease and impaired insulin resistance by higher levels of BMI, BMI reduction is highly recommended in this population. Female gender was associated with obesity. Educational level was another contributing factor in obesity in this population.^{5,27} The higher was the education; the lower was the obesity rate. Physical activity level showed no difference between two obesity groups.

Although most of patients were under treatment with oral hypoglycemic agents for diabetes control, hyperglycemia rate was high in this population. Health care providers should consider appropriate lifestyle changes and pharmaceutical therapy for patients who have not achieved the target for glucose control.²⁸

CONCLUSION

More than half of participants had poor glyceemic control. This research suggests that there is no relevance between obesity and poor glyceemic control in type 2 diabetic patients. It is necessary to explore other potential underlying risk factors for poor glyceemic control in diabetic patients.

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