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The Impact of Nutrition Education on Glycemic Control in Type 2 Diabetic Outpatients: A Retrospective Study

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Abstract

Introduction: It is widely accepted that glycemic control, diet, and weight management are core aspects in the management of T2DM. National diabetes education program shows it is possible to lose weight and have lower blood sugar levels. However, the impact of nutritional education on glycemic control in outpatients has not been well documented. The purpose of this study is to find out the effect of nutrition education on achieving optimal glycemic control in T2D outpatients as reflected by changes in HbA1c level. **Methods:** The study was retrospective and done for T2D outpatients at the visiting diabetic care center. Patients who received nutrition education were compared with those who did not receive it. Baseline and post-intervention characteristics including demographics, glycemic control, HbA1c level, and body mass index (BMI) were analyzed. Differences in glycemic control were assessed using paired and independent t-tests. **Results:** The sample size was 968 patients, out of which 333 patients were given nutrition education. There was a clear reduction in HbA1c from both groups, even though the reduction was greater in the T2DM group who received nutrition education (HbA1c: 8.10 ± 1.75 vs. $p > 0.01$ for 7.78 ± 1.54. There was a small elevation of the knee-normalized BMI of both groups but with a little more increase in the education group ($p < 0.05$). **Conclusion:** This study suggests that nutrition education significantly improves glycemic control among T2D outpatients, leading to a notable reduction in HbA1c levels. These findings emphasize the importance of incorporating personalized nutrition programs into diabetes management.

Keywords: Type 2 diabetes, glycemic control, nutritional education, HbA1c, dietitian intervention, outpatient care.
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Introduction

Diabetes type 2 is a rising global health problem, with its estimated prevalence greater than 537 million worldwide in the year 2021. It is projected that there will be an increase in numbers (1). Type 2 diabetes develops when the body has difficulty in using insulin which in turn causes an increase in blood sugar levels. This has the potential to lead to serious health issues including heart disease, nerve damage as well as kidney failure (2). The effective control of blood sugars is vital in preventing such complications and enhancing the life of a person with diabetes type 2 (3). Other studies suggest that nutritional education in hospitals or even outpatient clinics can have a positive impact on blood glucose levels and overall management of diabetes (4,5). There is a dearth of evidence regarding the positive impacts of nutrition education on diabetes management, especially in outpatient places in real-life circumstances (6). The structured type of nutrition education would have a role in achieving better glycemic control among diabetes type 2 patients attending outpatient settings at Hazm Mebaireek General Hospital HMGH.

Methods:

Study Design and Participants:

This retrospective study analyzed patient records from HMGH between January 1, 2024, and October 29, 2024. It included adults aged 18 and older diagnosed with T2D who attended at least one nutrition education session. Patients with type 1 diabetes or incomplete records were excluded. The nutrition education program, led by a registered dietitian or certified diabetes educator, focused on dietary strategies for managing blood sugar, such as carb counting, portion control, meal planning, and understanding food's impact on glucose levels. Participants had private counseling sessions and were encouraged to set personal dietary goals, with follow-up visits every three months.

Outcome:

The primary outcome was the change in HbA1c levels, a key marker of long-term blood sugar control. Secondary outcomes included changes in BMI. Patient demographics (age, gender, height, weight) were extracted from electronic health records.

Statistical Analysis:

Descriptive statistics were used for demographic data and baseline characteristics. Paired and independent t-tests assessed differences in HbA1c and BMI before and after nutrition education. A significant level of $p < 0.05$ was set for all tests. Data analysis was performed using IBM SPSS Statistics for Windows, Version 28.0.

Ethical Considerations:
This study was approved by the institutional review board (IRB) at [removed for blind peer review] and complied with Qatar's Ministry of Public Health regulations and the Declaration of Helsinki. Patient data was anonymized, and informed consent was waived due to the study's retrospective nature.

Results
The sample consisted of diabetes type 2 men with a mean age of 51.18 ± 9.82 years, a mean height of 167.58 ± 10.78 cm, and a mean weight of 80.93 ± 35.09 kg. The average BMI was 29.54 ± 18.29. Regarding BMI categories, 0.3% were classified as underweight, 28.2% as normal weight, 42.5% as overweight, and 29.0% as obese. Most participants were non-Qatari, with 1.1% identified as Qatari, 14.7% as Arabic, and 84.2% as from other nationalities. Regarding the study group referred to a dietitian for education, 34.4% were in the "yes" group while 65.6% were in the "no" group as shown in **Table 1**. **Table 2** presents a comparison of BMI and HbA1c levels before and after referral to a dietitian for education. For individuals who were not referred to a dietitian (n = 635), there was no significant change in BMI (28.98 ± 17.88 before vs. 30.25 ± 26.07 after; p = 0.64), but a significant decrease in HbA1c levels (7.74 ± 1.58 before vs. 7.48 ± 1.35 after; p = 0.00). In contrast, individuals who were referred to a dietitian (n = 333) showed a slight but significant increase in BMI (28.72 ± 5.94 before vs. 28.76 ± 5.36 after; p = 0.00) and a significant reduction in HbA1c levels (8.10 ± 1.75 before vs. 7.78 ± 1.54 after; p = 0.00). These findings suggest that while BMI showed minimal change in both groups, HbA1c improved significantly following dietary education, with those referred to a dietitian showing a more pronounced reduction in HbA1c levels. **Table 3** compares the study variables (BMI and HbA1c) between individuals referred to a dietitian for education and those not referred. The two groups had no significant difference in BMI before education (28.72 ± 5.94 for those referred vs. 28.98 ± 17.88 for those not referred; p = 0.23). However, after education, individuals referred to a dietitian had a significantly lower BMI (28.76 ± 5.36) compared to those not referred (30.25 ± 26.07), with a p-value of 0.02. Regarding HbA1c levels, individuals referred to a dietitian had significantly higher levels before education (8.10 ± 1.75) compared to those not referred (7.74 ± 1.58; p = 0.01). After education, those referred to a dietitian showed a significant reduction in HbA1c (7.78 ± 1.54) compared to those not referred (7.48 ± 1.35), with a p-value of 0.01. These results indicate that, after dietitian education, both BMI and HbA1c improved significantly, with a more substantial change observed in individuals who were referred to a dietitian

Discussion
It is evident from our analysis that nutritional education helps enhance the blood glucose management of type 2 diabetes mellitus. It was helpful for recipients of dietary counseling with a dietitian in achieving lower levels of HbA1c as an index of chronic control of blood glucose. This corroborates the findings outlining the role of structured nutrition programs in diabetes management. These results agree with previous studies indicating that nutritionally tailored suggestions improve blood sugar metrics, especially for those patients with higher levels of HbA1c (7). Interestingly, the group educated by the dietitian had a slightly higher BMI, but this does not necessarily indicate increased body weight. It is possible that the increase was due to muscle mass, which the BMI measure does not fully reflect (8). Moreover, participants with higher starting HbA1c had lower mean blood glucose values and blood pressure levels, which means that more aggressive and individualized diet programs can be useful for these people. (9). Such results provide a clear rationale for incorporating dietitians in the management of patients with T2D, particularly in outpatient clinics. Evidence demonstrates that personally tailored nutritional advice affects the macro- and micro-nutrition outcomes of patients. However, there are some limitations to this study. Since it relied on retrospective data, it could be subject to biases or missing information. Additionally, factors like changes in medication or exercise, which might also influence blood sugar control, were not accounted for. Further research is needed to confirm these results and to explore the long-term benefits of nutritional education in outpatient care.

Conclusion
The research reveals that nutrition education was effective in reducing HbA1c levels amongst T2D patients which resulted in better glycemic control. This points towards the fact that containing diabetes requires greater emphasis on education relating to nutrition as well as a change in the overall structure of the healthcare plan being provided.

Declaration of Interest

The authors declare that they have no conflicts of interest related to this study

Table 1. Characteristics of the patients investigated (N=968).

BMI: Body mass index.

Variables	*Mean ± SD*
Age	51.18 ± 9.82
Height	167.58 ± 10.78
Weight	80.93 ± 35.09
BMI	29.54 ± 18.29
	N (%)
BMI categories	
Underweight	3 (0.3)
Normal weight	273 (28.2)
Overweight	411 (42.5)
Obese	281 (29.0)
Nationality	
Qatari	11 (1.1)
Arabic	142 (14.7)
Other	815 (84.2)
Referred to a dietitian for an education	
yes	333 (34.4)
no	635 (65.6)

Table 2. Comparison of study variables (means ± SD) within groups referred to dietitians for education.

Referred to dietitian for education	***BMI***		***P-values***	***HbA1c***		***P- values***
	before	***after***		***before***	***after***	
No (n=635)	28.98 ±17.88	30.25 ± 26.07	0.64	7.74 ± 1.58	7.48 ± 1.35	0.00
Yes (n=333)	28.72 ± 5.94	28.76 ± 5.36	0.00	8.10 ± 1.75	7.78 ± 1.54	0.00

*BMI: Body mass index, HbA1c: Hemoglobin A1C. Significant $p < 0.05$

Table 3. Comparison of study variables (means ± SD) between groups referred to dietitians for education.

Variables	***Referred to dietitian for education***	***means ± SD***	***P- values***
BMI before education	Yes	28.72 ± 5.94	0.23
	No	28.98 ± 17.88	
BMI after education	Yes	28.76 ± 5.36	0.02
	No	30.25 ± 26.07	
HbA1c before education	Yes	8.10 ± 1.75	0.01
	No	7.74 ± 1.58	
HbA1c after education	Yes	7.78 ± 1.54	0.01
	No	7.48 ± 1.35	

*BMI: Body mass index, HbA1c: Hemoglobin A1C. Significant $p < 0.05$

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