ORIGINAL ARTICLE

Nutritional Status, Glycemic Response and Dietary Compliance of Newly Diagnosed Versus long term Patients with type II diabetes

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Abstract

Type II Diabetes Mellitus is a growing public health concern in India, with dietary habits, body composition, and long-term glycemic control playing a crucial role in disease management. To assess the nutritional profile, glycated hemoglobin, and dietary compliance of Type II Diabetics, with newly diagnosed (N = 79) and long-term (N = 71) patients. Data was collected for anthropometry, 24-hour dietary recall, HbA1c and dietary compliance. BMI in the newly diagnosed group was 26 $\pm$ 4 kg/m2) and for the long term group it was 27 $\pm$ 3 kg/m2 (p=0.081) with significant differences across BMI categories in the two groups (p=0.04). The recommendation for energy and protein intake was met by the newly diagnosed group, while the long-term group's energy and protein intake met 93.9% and 88.6% adequacy, respectively. HbA1c values were better in newly diagnosed subjects (p = 0.07), but dietary compliance scores were higher in the long-term group. The correlation between HbA1c and dietary compliance was very weak and not correlated. In conclusion, nutritional status of both the groups was similar, newly diagnosed diabetics demonstrated better nutrient adequacy and glycemic control, whereas long-term diabetics showed greater dietary compliance, underscoring different challenges across disease stages.

Keywords

Type II Diabetes; Nutritional Status; HBA1C; Glycemic Response; Dietary Compliance

Introduction

With rising diagnosis rates, type 2 diabetes (T2DM) is becoming a common chronic illness worldwide, particularly in younger and overweight people. The rise in T2DM is linked to lifestyle factors like poor diet, obesity, and sedentary behaviours, along with genetic and epigenetic influences (1). According to data from the International Diabetes Federation (IDF), 463 million adults worldwide had diabetes in 2019, and estimates indicate that by 2045, that number will have increased by 46% to 783 million (2).

Effective management can be achieved by improving lifestyle practices and maintaining good glycemic control, as evidenced by HbA1c levels, which are crucial in assessing the disease's progression and complications (3,4).Nutritional education plays a significant role in disease management by improving dietary practices and reducing the risk of further complications (5). This study aims to deepen understanding on the nutritional status, glycemic management and dietary compliance of T2DM patients, contributing to better health outcomes and prevention strategies.

Objective of the study:

- To compare the nutritional status of newly diagnosed and long term patients with Type II Diabetes.
- To compare glycated hemoglobin of the above groups.
- To compare dietary compliance score of the study groups.

Material & Methods

Study Type: Original

Study Design: The study design of the present study was cross sectional.

Study setting: Sewa Bharti Diagnostic and Dialysis Centre, Ashok Vihar, Delhi

Study Population: Adult Type II Diabetic subjects diagnosed by a Physician.

Study Duration: Duration of the study was from July 2023 to May 2024.

Sample Size: 150 patients (79 newly diagnosed & 71 long term Diabetic subjects)

nclusion Criteria for both groups:

In the newly diagnosed group, Type II Diabetic patients on oral medication who had been diagnosed not more than six months ago were included.

In the long term group, Type II Diabetic patients on oral medication who had been diagnosed more than 5 years ago were included.

Type II Diabetic patients with HbA1c reports of within three months.

Exclusion Criteria for both groups:

Type I Diabetics and Type II Diabetics on insulin, patients Suffering from Liver Cirrhosis, Malignancy, CKD, CVD, TB, Pregnant and Lactating females. Patients on long fasts and Persons with disabilities.

Strategy for Data collection: Purposive sampling method was used for the selection of different sample units. Socio-demographic data was collected using a structured questionnaire covering variables such as Age, Gender, Education, Occupation, Family Monthly Income, Socio-Economic status (Kuppuswamy, 2022).

Anthropometric Measurements: Height, weight was measured and BMI was calculated.

HbA1C Measurement: HbA1c reports within the last three months was recorded.

Dietary Intake Measurement: The Food and Nutrient intake was assessed with the help of a 24 Hour dietary recall method for 3 days (2 working and 1 holiday). Quantities consumed were noted in common household measures.

Recommended intake was calculated for Energy, Protein, Carbohydrate and Fats (ICMR, 2018). First the IBW was determined for each patient and thereafter the recommended energy intake was calculated for each patient. After calculating the recommended intake for each patient. Percent adequacy was evaluated using the calculated recommendation and actual intake.

The energy recommendation is 25 kcal/ kg IBW, of which 55-60%, 12-15%, 20-30% should come from carbohydrates, proteins and fats respectively.

Dietary Compliance: To evaluate the dietary compliance of diabetic diets, food group intake was assessed. These food groups included Cereals, Pulses, Milk, Sweets and Miscellaneous, Fruits and Salads, Oils, Eggs and Non vegetarian items. A self-structured questionnaire was prepared to assess the dietary compliance. This questionnaire was designed to assess adherence to dietary recommendations over the past three months. The questionnaire included a total of 41 questions, with 36 questions for vegetarians and additional 5 questions for non-vegetarians. Each correct answer was given 1 mark, while incorrect answers were given 0 marks. Therefore the maximum score that could be obtained by a vegetarian could be 36, while the maximum score which could be obtained by a non-vegetarian could be 41. The

questionnaire included multiple-choice questions that covered the frequency and portion sizes of different food groups. The score was calculated for each patient and categorized as given in Table 1.

Table 1 Classification of Dietary Compliance Score

Classification	Score for Vegetarians	Score for Non - Vegetarians
Good	25 to 36	29 to 41
Average	13 to 24	15 to 28
Poor	0 to 12	0 to 14

Working Definitions:

Nutritional Status: WHO (6) criteria for BMI Classification was used for classification of Nutritional Status.

HbA1C: ADA (4) criteria for HbA1c was used to classify subjects into different HbA1c categories.

Dietary Compliance: Self structured questionnaire with 41 items containing both quantitative and qualitative questions.

Ethical consideration: In the present study no intervention was done and data for HbA1c was collected from the records of the patients. Anthropometry and diet assessment was also done.

Informed Consent: The study was explained to each participant. A written consent was obtained from each patient. At all occasions, patient privacy and confidentiality were protected.

Data Analysis: The data was analyzed by preparing a master sheet. Continuous data were expressed as Mean + S.D., whereas categorical variables were expressed as frequency. The t-test was used to compare the means of the two groups. Association between the variables was evaluated using the chi-squared test. The collected dietary information was entered into Dietcal software, which is designed to analyze nutrient intake. All the statistical analysis were done using SPSS.

RESULTS

Socio Demographic profile: The study participants in the newly diagnosed group were 48 $\pm$ 5 years old on average (N = 79, males = 42, females = 37), whereas the study participants in the long-term group were 46 $\pm$ 5 years old on average (N = 71, males = 34, females = 37).In the newly diagnosed group 80% subjects were Vegetarian and 20% were non-vegetarians where as in the long term diabetic group 58% subjects were vegetarian and 42% subjects were non-vegetarian. Hypertension was seen in 25% subjects in newly diagnosed group and 35% subjects in the long term diabetic group. In the newly diagnosed group 32% subjects suffered from other diseases and 27% subjects in long term diabetic group suffered from other diseases.

Socio -Economic profile: In the present study, 41 % subjects in the newly diagnosed group and 42% subjects in the long term diabetic group belonged to lower middle SES category. Further 37% subjects in the newly diagnosed group and 28% subjects from the long term diabetic group belonged to upper middle SES. The socioeconomic profiles of the two groups did not differ significantly (p=0.425).

Nutritional Status: The individuals' mean weight was 69 $\pm$10 kg in the long-term group and 66 $\pm$11 kg in the newly diagnosed group. The mean weights of the two groups did not differ significantly (p=0.08). The subjects' mean height was 161$\pm$5 cm for the newly diagnosed group and 163 $\pm$5.2 cm for the long-term group. The mean height of the participants in the two groups differed significantly (p=0.017). Subjects in the long-term group had a mean BMI of 27$\pm$3 kg/m2, whereas those in the newly diagnosed group had a mean BMI of 26 $\pm$ 4 kg/m2. The mean BMI of the two groups did not differ significantly (p=0.081). The BMI categories of the two groups differ significantly, as seen in Table 2.

This means that the distribution of subjects according to their BMI in the three categories of BMI is not similar.

Food Intake: The mean food group intake of new onset and long term diabetic group is given in Table 3. Females in the newly diagnosed group were consuming more fruits and fats as compared to the long term group.

Nutrients intake: Table 4 shows the mean intake of nutrients consumption from various

food consumed by newly diagnosed and long term diabetic groups. The recommendation for energy and protein intake was met by the newly diagnosed group while the long-term group's energy and protein intake met 93.9% and 88.6% adequacy, respectively.

Glycated Haemoglobin (HbA1c): Table 5 shows better blood sugar control was seen in the newly diagnosed group as more number of patients had HbA1c values below 8.5%. More number of patients in the long term group had higher HbA1c values as compared to newly diagnosed group although it is not significant (p=0.07) but the trend shows nearing significant.

Dietary Compliance (DC): Table 6 shows there was a statistically significant difference between the dietary compliance score of the two groups (p= 0.04) among the vegetarians but clinically difference of one score is not much significant as shown by the results. The dietary compliance of the long term subjects was better in the non-vegetarian group. The non-vegetarians' dietary compliance score differed significantly (p=0.01) from the other groups. Therefore we may say that the dietary compliance score was better in the long term group in both vegetarians and non-vegetarians.

The dietary compliance score classification is shown in Table 7.

Correlation between Dietary Compliance score and Glycated Haemoglobin (HbA1c):

In both the groups, the correlation between HbA1c levels and dietary compliance for both vegetarian and non-vegetarian groups was very weak and not correlated.

Table 2: Distribution of subjects based on Nutritional Status

Classification	WHO (2016)	Newly diagnosed (N=79)			Long term (N=71)			p value
		Male (N)	Female (N)	Total N (%)	Male(N)	Female (N)	Total N (%)	
Normal Weight	18.5-24.9 (kg/m^2)	22	21	43(54 %)	19	14	33(46 %)	0.04
Overweight	25-29.9 (kg/m^2)	10	10	20(25%)	11	16	27(38 %)	
Obese	Above 30 (kg/m^2)	10	6	16(21 %)	4	7	11(15 %)	

Table 3 Food Group Intake per day among the study subjects

Food Groups	Female			Male		
	Newly diagnosed (N=37)	Long term (N=37)	p value	Newly diagnosed (N=42)	Long term (N=34)	p value
	Mean ± SD	Mean ± SD		Mean ± SD	Mean ± SD	
Cereals and Millet (gm)	110 ± 44	125 ±34	0.1	103± 52	120 ±42	0.1
Pulses(gm)	52 ± 41	54 ± 34	0.82	60 ± 43	54 ± 33	0.5
Egg/ Meat/ Fish (gm)	4±13	4 ±9	0.1	8±17	1 ±5.7	0.02
Green leafy vegetable(gm)	15 ± 19	10± 18	0.24	14 ±21	7± 11	0.08
Other vegetables(gm)	100 ± 51	108± 57	0.52	123 ± 71	128± 51	0.73
Roots vegetables(gm)	25 ±24	22±16	0.52	35 ±42	32±34	0.73
Fruits(gm)	31 ± 26	19±17	0.02	31 ± 31	21±22	0.11
Milk and milk products(ml)	207±83	202±61	0.78	209±70	219±76	0.55
Fats and oils(gm)	28 ± 9	23±8	0.01	24 ± 7.4	24±7.4	1
Nuts and Oil seeds (gm)	4±6	3±4	0.4	5±4	4±4.5	0.3
Spices(gm)	40 ± 25	45±22	0.36	48± 27	51±22	0.6

Table 4 Macro nutrient intake per day of study subjects

Macronutrients	Newly diagnosed (N=79)			Long term (N=71)		
	(ICMR 2018)	Nutrients intake Mean ± SD	p value	(ICMR 2018)	Nutrients intake Mean ± SD	p value
Energy(kcal)	1385± 221	1379±120	0.83	1511 ±257	1420 ±102	<0.01
Protein(gm/d)	52 ±4	51± 13	0.51	53 ±4	47 ± 13	<0.01
Carbohydrate (gm/d)	207 ± 18	175 ±36	<0.01	213 ±15	172± 38	<0.01
Fats (gm/d)	51 ±12	46 ± 4	<0.01	48 ±12	39 ±3	<0.01

Table 5: HbA1c Values of Study Subjects

Hba1c Categories	Newly diagnosed(N=79)	Long term (N=71)	p value
6.5-7.5%	19(24 %)	16(23 %)	0.07
7.6-8.5%	42(53 %)	32(45 %)	
8.6-9.5 %	17(21.5 %)	18(25 %)	
9.6-10.5%	1(0.01 %)	5(7 %)	
Mean± SD	8.2 ±0.7	8.3 ±0.8	0.4

Table 6: Dietary compliance score in study subjects

Dietary compliance	Newly diagnosed (N=79)			Long term (N=71)			p value
	Mean ± SD	Max-Min	N	Mean ± SD	Max -Min	N	
Vegetarian	22±3	30-14	61	23 ±3	28-18	41	0.04
Non Vegetarian	23 ±3	28-15	18	26 ±4	31-19	30	0.01

Table 7: Dietary compliance Score classification of study subjects

Dietary Compliance	Vegetarian			Dietary Compliance Score	Non-Vegetarian		
	Newly diagnosed (N=79)	Long term (N=71)	p value		Newly diagnosed (N=18)	Long term (N=30)	p value
Good (25 to 36)	19 (24 %)	23(32 %)	0.25	Good (31 to 41)	0	1(3.3%)	0.73
Average (13 to 24)	60(76%)	48(68 %)		Average(16 to 30)	18(100%)	29(97%)	
Poor (0 to 12)	0	0		Poor (0 to 15)	0	0	

DISCUSSION

The current study compared the nutritional status, glycated hemoglobin, and dietary compliance score of newly diagnosed and long term Type II Diabetic patients.

While our study observed disparities in height and BMI categories, similar studies have not demonstrated a significant difference in BMI between newly diagnosed and long-term T2DM patients (5). In the newly diagnosed group, the percentage of normal weight (54%) and obese (21%) subjects is higher as compared to long term group whereas the percentage of overweight subjects (38%) is higher in the long term group. There might be a possibility that the subjects in the obese category in the long term group have adhered to the counselling given to them and have reduced their weight and have now come in the category of overweight from obese.

In the newly diagnosed group there are more number of subjects who are normal weight and obese, however their energy and protein intake is as per the ICMR recommendation(7) while their HbA1c is better controlled,their dietary compliance is average.
Additionally, in the long term group, more number of subjects were overweight, their energy and protein intake met 93.9% and 88.6% adequacy and their HbA1c was poorly

controlled while dietary compliance was slightly better in the long term group. Fruit intake was higher among newly diagnosed patients, which may reflect initial dietary changes post-diagnosis.

HbA1c levels between newly diagnosed and long-term patients were similar suggesting that dietary habits may not directly influence glycemic control in the short term (5). Interestingly, our results also indicate weak correlations between diet and HbA1c levels, which supports findings by other researchers (8), who observed that while dietary factors impact glycemic control, the relationship is often complex and mediated by other factors like medication adherence, physical activity, stress etc. The significant differences in dietary compliance scores between newly diagnosed and long-term groups, especially among non-vegetarians, suggest that sustained adherence to a diabetic diet might improve over time, but the relationship remains weak in terms of direct HbA1c reduction (8,9,10). Overall, dietary compliance and nutrient intake have a nuanced impact on diabetes management, and further longitudinal studies are required for clearer insights.

Conclusion

Although no significant BMI differences were found between newly diagnosed and long-term patients, variations in BMI categories were observed. Newly diagnosed patients showed better HbA1c control, with nutrient intake adhering to ICMR recommendations, despite average dietary compliance. In contrast, long-term patients had lower energy and protein intake adequacy but exhibited poor glycemic control, indicating that long-term dietary habits alone may not be sufficient for optimal diabetes management. Further research is needed to explore the complex relationship between diet, lifestyle, and glycemic control in diabetes management.

Recommendation

We are unable to make any recommendations based on the findings of the study since the sample size was small and the study was conduced in one diagnostic centre only.

Limitation of the Study

- The study was conducted at a single centre in Delhi, which limits the generalization of findings to other regions or populations.
- The sample size was not calculated and relatively small (N = 150).
- Lifestyle factors such as stress levels, sleep patterns, and daily routines were not assessed.
- Physical activity levels of participants were not studied.
- Medical adherence, including consistency in following prescribed medications, was not examined.

Relevance of the Study

The findings of the study emphasize that while newly diagnosed patients manage better with nutrition and HbA1c, long-term patients sustain stronger dietary compliance. Therefore we need to focus on both the groups for sustained improvements and compliance of Type II Diabetes.

Authors Contribution

All the authors have contributed equally.

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Nil

Conflict of Interest

There are no conflicts of interest of all authors.

Declaration Of Generative AI And AI Assisted Technologies In The Writing Process

The authors haven't used any generative AI/AI assisted technologies in the writing process.

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