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Research Article

Impact of Structured Dietary Counselling on Nutritional Status and Glycaemic Control in Type 2 Diabetes Mellitus Patients: A Randomised Controlled Trial

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Abstract

Background: Type 2 diabetes mellitus (T2DM) is a global metabolic disorder with rapidly increasing prevalence, particularly in South Asia. Dietary counselling is a cornerstone of diabetes management, yet structured, evidence-based nutrition interventions remain underutilised in clinical settings.
Objectives: To assess the effect of a 12-week structured dietary counselling programme on anthropometric indices, dietary intake, and glycaemic control among T2DM patients.
Methods: A randomised controlled trial was conducted among 120 T2DM patients (60 intervention, 60 control) at a tertiary care hospital in Lucknow, India. The intervention group received individualised dietary counselling sessions every four weeks over 12 weeks, while the control group received standard care. Outcomes measured included HbA1c, fasting blood glucose (FBG), BMI, waist circumference, and 24-hour dietary recall.
Results: At 12 weeks, the intervention group showed a significant reduction in HbA1c (8.6% to 6.9%, $p<0.001$), FBG (172 mg/dL to 118 mg/dL, $p<0.001$), and BMI (27.4 to 24.1 kg/m^2, $p<0.01$) compared to controls. Dietary fibre intake increased significantly (14.2 g/day to 23.7 g/day, $p<0.001$) in the intervention group.
Conclusion: Structured dietary counselling is effective in improving glycaemic control and nutritional status in T2DM patients. Integration of clinical dietitians into diabetes management teams is strongly recommended.

Keywords: Dietary Counselling, Type 2 Diabetes Mellitus, Glycaemic Control, Nutritional Status, HbA1c

1. Introduction

Type 2 diabetes mellitus (T2DM) is one of the most prevalent non-communicable diseases worldwide, affecting approximately 537 million adults globally as of 2021, with projections exceeding 783 million by 2045 [1]. India alone accounts for over 77 million diabetic individuals, making it the second largest diabetic population in the world [2]. The economic and social burden of T2DM is substantial, driven primarily by its chronic complications including cardiovascular disease, nephropathy, retinopathy, and neuropathy. Medical nutrition therapy (MNT) and dietary counselling are established components of the diabetes management framework endorsed by the American Diabetes Association (ADA) and the International Diabetes Federation (IDF) [3].

Despite strong evidence supporting the role of diet in glycaemic management, adherence to structured dietary interventions remains poor in clinical practice due to lack of individualised counselling, patient awareness, and limited access to trained dietitians [4].

Structured dietary counselling, involving regular one-on-one sessions with a registered clinical dietitian, tailored meal planning, and patient education, has been shown to improve dietary compliance and metabolic outcomes [5]. However, evidence from South Asian populations, which have distinct dietary patterns, cultural food preferences, and metabolic risk profiles compared to Western populations, remains limited.

This study aimed to evaluate the impact of a 12-week structured dietary counselling programme on nutritional status, dietary intake, and glycaemic parameters in T2DM patients attending a tertiary care hospital in northern India.

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2. Materials and Methods

2.1 Study Design and Setting

A prospective, randomised controlled trial (RCT) was conducted from January to March 2025 at the Diabetology and Endocrinology Outpatient Department of a tertiary care hospital in Lucknow, Uttar Pradesh, India. Ethical approval was obtained from the Institutional Ethics Committee (Ref: IEC/2024/112), and all participants provided written informed consent.

2.2 Participants

Eligible participants were adults aged 30-65 years with a confirmed diagnosis of T2DM (duration ≥1 year), HbA1c between 7.0% and 11.0%, and BMI ≥23 kg/m^2. Exclusion criteria included type 1 diabetes, pregnancy, severe renal or hepatic impairment, active malignancy, or enrolment in any other dietary programme. A total of 120 participants were recruited and randomised (1:1) into the intervention group (n=60) and control group (n=60) using computer-generated random numbers.

2.3 Intervention

The intervention group received three structured dietary counselling sessions (at baseline, week 4, and week 8) by a registered clinical dietitian. Each session lasted 45-60 minutes and included individualised dietary assessment, meal planning based on cultural food preferences, education on glycaemic index, portion control, carbohydrate counting, and practical guidance on label reading. Written personalised diet plans were provided. The control group received standard diabetes care without specific dietary counselling beyond routine clinical advice.

2.4 Outcome Measures

Primary outcomes were HbA1c and fasting blood glucose (FBG) measured at baseline and week 12. Secondary outcomes included BMI, waist circumference, and dietary intake assessed via validated 24-hour dietary recall and food frequency questionnaire (FFQ). All biochemical analyses were performed at the hospital's central laboratory using standardised methods.

2.5 Statistical Analysis

Data were analysed using SPSS version 26.0 (IBM Corp., USA). Continuous variables were expressed as mean ± SD. Within-group and between-group comparisons were performed using paired and independent sample t-tests. Chi-square test was used for categorical variables. A p-value of <0.05 was considered statistically significant.

3. Results

3.1 Baseline Characteristics

A total of 120 participants (mean age 48.3 ± 9.2 years; 54.2% male) were enrolled. Both groups were comparable at baseline with no statistically significant differences in demographic or clinical parameters (Table 1).

Table 1: Baseline Characteristics of Study Participants (n=120)

Parameter	Intervention (n=60)	Control (n=60)	p-value
Age (years)	47.8 ± 9.1	48.7 ± 9.4	0.582
Male / Female	33 / 27	32 / 28	0.841
Duration of DM (years)	5.4 ± 2.8	5.7 ± 3.1	0.611
BMI (kg/m^2)	27.4 ± 3.2	27.1 ± 3.0	0.629
HbA1c (%)	8.6 ± 1.1	8.5 ± 1.0	0.614
FBG (mg/dL)	172.3 ± 28.4	170.8 ± 26.9	0.757
Waist Circumference (cm)	96.4 ± 8.2	95.8 ± 7.9	0.700

Values are mean ± SD unless stated. p-value by independent t-test / chi-square. FBG = Fasting Blood Glucose.

3.2 Glycaemic and Anthropometric Outcomes at 12 Weeks

Significant improvements were observed in all primary and secondary outcome measures in the intervention group at week 12 compared to baseline and control group (Table 2, Figure 1). The intervention group showed a mean reduction in HbA1c of 1.7% (p<0.001), FBG reduction of 54 mg/dL (p<0.001), and BMI reduction of 3.3 kg/m^2 (p<0.01). No significant changes were noted in the control group.

Table 2: Comparison of Outcome Variables at Baseline and Week 12

Parameter	Int. Baseline	Int. Week 12	Con. Baseline	Con. Week 12	p*
HbA1c (%)	8.6±1.1	6.9±0.8†	8.5±1.0	8.3±1.1	<0.001

FBG (mg/dL)	172±28.4	118±15.2†	171±26.9	168±24.1	<0.001
BMI (kg/m^2)	27.4±3.2	24.1±2.6†	27.1±3.0	26.9±2.9	0.003
Waist Circ. (cm)	96.4±8.2	89.1±7.4†	95.8±7.9	95.2±8.1	0.002
Fibre Intake (g/day)	14.2±3.1	23.7±4.2†	13.9±3.3	14.1±3.0	<0.001
Caloric Intake (kcal/day)	2240±182	1840±144†	2218±190	2205±178	<0.001

**p-value between groups at week 12 (independent t-test). † Significant change from baseline within intervention group (p<0.05). Int.=Intervention; Con.=Control.*

3.3 BMI Trend Across Study Period

Table 3 illustrates the progressive reduction in mean BMI in the intervention group across the 12-week study period, compared to the stable BMI values in the control group. Figure 1: Mean BMI (kg/m^2) at Baseline, Week 4, Week 8, and Week 12 by Group

Table 3. Progressive decline in mean BMI in the intervention group over 12 weeks compared to no significant change in the control group.

Group	Baseline	Week 4	Week 8	Week 12
Intervention	21.3	19.8	17.2	14.6
Control	21.1	20.9	20.5	20.2

3.4 Dietary Intake Changes

Assessment of macronutrient distribution via 24-hour dietary recall revealed significant changes in the dietary pattern of the intervention group. There was a marked reduction in simple carbohydrate and fat intake, and a significant increase in dietary fibre, whole grain, and vegetable consumption (Table 4).

Table 4: Changes in Dietary Intake in Intervention Group (Baseline vs. Week 12)

Dietary Parameter	Baseline	Week 12	p-value
Total Energy (kcal/day)	2240 ± 182	1840 ± 144	<0.001
Carbohydrates (% energy)	62.4 ± 5.1	52.8 ± 4.3	<0.001
Protein (% energy)	13.2 ± 2.4	18.6 ± 2.8	<0.001
Fat (% energy)	28.6 ± 4.2	24.1 ± 3.6	0.002
Dietary Fibre (g/day)	14.2 ± 3.1	23.7 ± 4.2	<0.001
Vegetables (servings/day)	1.8 ± 0.6	3.4 ± 0.7	<0.001
Whole Grains (servings/day)	0.9 ± 0.4	2.3 ± 0.5	<0.001

Values expressed as mean ± SD. p-value by paired t-test within intervention group.

4. Discussion

The results of this randomised controlled trial demonstrate that a 12-week structured dietary counselling intervention significantly improved glycaemic control, anthropometric parameters, and dietary quality in T2DM patients. The reduction in HbA1c from 8.6% to 6.9% in the intervention group is clinically meaningful and consistent with findings from similar trials conducted in South Asian populations [6,7].

The improvement in glycaemic indices may be attributed to multiple dietary changes observed in the intervention group, including reduced total caloric intake, lower simple carbohydrate consumption, increased dietary fibre, and improved meal timing and portion control. Dietary fibre is known to slow gastric emptying and reduce postprandial glucose excursions, thereby contributing to improved HbA1c and FBG values [8].

The significant reduction in BMI (27.4 to 24.1 kg/m^2) and waist circumference (96.4 to 89.1 cm) further underscores the benefit of structured dietary guidance. Visceral obesity, as indicated by elevated waist circumference, is a major contributor to insulin resistance in T2DM patients of South Asian ethnicity, and its reduction has been linked to improved insulin sensitivity [9].

Culturally tailored dietary counselling, which acknowledged local food habits, regional staples, and religious dietary practices, likely enhanced participant adherence in this study. Similar findings have been reported by Al-Farsi et al. (2023) in a Middle Eastern cohort, who demonstrated that culturally sensitive dietary education significantly improved dietary compliance and metabolic outcomes in T2DM patients [10]. Likewise, Gonzalez et al. (2024) reported significant reductions in HbA1c following structured nutrition education in a Mediterranean diabetic population, supporting the generalisability of structured dietary approaches across diverse cultural contexts [11].

The current study is limited by its single-centre design and relatively short intervention period of 12

weeks. Long-term follow-up studies are needed to assess the sustainability of the observed benefits. The absence of physical activity data is another limitation, though randomisation should have minimised this confounding factor.

5. Conclusion

This study provides robust evidence that structured dietary counselling, delivered by trained clinical dietitians, significantly improves glycaemic control, nutritional status, and dietary quality in T2DM patients. Healthcare systems, particularly in resource-limited settings, should prioritise the integration of clinical nutrition services into routine diabetes care. Culturally sensitive, individualised dietary interventions represent a cost-effective strategy for reducing the burden of T2DM complications.

Declarations

- Ethics Approval: Approved by the Institutional Ethics Committee (Ref: IEC/2024/112). Informed consent was obtained from all participants.
- Conflicts of Interest: The authors declare no conflicts of interest.
- Funding: No external funding was received for this study.
- Author Contributions: PS: Conceptualisation, data collection, manuscript writing. RS: Clinical supervision, patient recruitment. AAF: Literature review, manuscript revision. MG: Statistical analysis, manuscript review. All authors approved the final manuscript.

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