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Research Paper

Effect of Dietary Supplementation as an Adjunct to Medical Nutrition Therapy in a Woman with Type 2 Diabetes Mellitus: A Case Study

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Abstract

Background: Type 2 diabetes mellitus (T2DM) is a major metabolic disorder characterized by chronic hyperglycemia and associated with an increased risk of cardiovascular, renal, neurological and other complications. Medical nutrition therapy (MNT), physical activity, medication adherence and lifestyle modification are important components of diabetes management. Dietary supplementation, particularly supplementation with soluble dietary fiber, may provide additional nutritional support when appropriately incorporated into an individualized dietary plan.

Objective: The present case study aimed to assess the effect of a structured dietary intervention combined with a soluble-fiber-containing dietary supplement on anthropometric measurements and selected glycemic parameters in a woman with T2DM.

Methods: An illustrative case of a 52-year-old woman with T2DM was followed for 12 weeks. At baseline, the participant had a body weight of 76.8 kg, height of 158 cm, body mass index (BMI) of 30.8 kg/m², fasting blood glucose (FBG) of 158 mg/dL and glycated hemoglobin (HbA1c) of 8.1%. She was receiving stable oral antidiabetic medication. An individualized 1,500–1,600 kcal/day meal plan emphasizing vegetables, whole grains, pulses, adequate protein, controlled carbohydrate portions and reduced added sugars was prescribed. A soluble-fiber supplement providing approximately 5 g fiber per serving was administered once daily before the main meal. Physical activity was progressively increased. Anthropometric and biochemical parameters were monitored at baseline, 4, 8 and 12 weeks.

Results: At 12 weeks, body weight decreased from 76.8 to 72.9 kg, BMI from 30.8 to 29.2 kg/m², and waist circumference from 98 to 92 cm. FBG decreased from 158 to 124 mg/dL, while HbA1c decreased from 8.1% to 7.2%. The participant reported improved satiety, reduced snacking and better adherence to the prescribed meal plan. No significant adverse effects associated with the dietary supplement were reported.

Conclusion: In this illustrative case, dietary supplementation with soluble fiber, when integrated with individualized MNT, physical activity and appropriate medical treatment, was associated with improvements in glycemic control and anthropometric parameters. The findings support the potential role of dietary fiber supplementation as an adjunct rather than a replacement for standard diabetes management. Larger controlled studies are required to establish the independent effects of supplementation

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1. INTRODUCTION

Type 2 diabetes mellitus is one of the most common chronic metabolic disorders worldwide. It is characterized primarily by insulin resistance, progressive impairment of pancreatic beta-cell function and persistent elevation of blood glucose. Poorly controlled diabetes is associated with microvascular and macrovascular complications and places a substantial burden on individuals and health-care systems.

Nutrition plays a central role in the management of diabetes. Current evidence does not support a single dietary pattern or macronutrient distribution that is optimal for every person with diabetes. Instead, dietary management should be individualized according to metabolic goals, food preferences, cultural practices, socioeconomic circumstances and lifestyle [1]. The American Diabetes Association emphasizes that medical nutrition therapy should form an integral component of diabetes management and should aim to improve glycemic control, support healthy body weight and reduce cardiovascular risk [1,2].

Dietary carbohydrate is particularly important because the quantity, quality and distribution of carbohydrate-containing foods influence postprandial blood glucose. Current recommendations emphasize nutrient-dense carbohydrate sources such as vegetables, legumes, fruits and whole grains while minimizing refined grains, added sugars and sugar-sweetened beverages [2]. Individualized carbohydrate management can therefore be useful in achieving glycemic targets.

Dietary fiber is another important component of diabetes nutrition therapy. Naturally fiber-rich foods include vegetables, fruits, legumes, whole grains, nuts and seeds. Fiber may influence glucose absorption, gastric emptying, satiety and insulin sensitivity. An umbrella review of meta-analyses reported that higher dietary fiber intake was associated with a lower risk of developing T2DM and that supplemental fibers such as psyllium and beta-glucan were associated with modest reductions in fasting blood glucose and glycated hemoglobin among individuals with T2DM [3].

The possible role of soluble and viscous fiber supplementation has been investigated in randomized controlled trials. A meta-analysis published in 2019 included 28 eligible trial comparisons involving 1,394 participants and found that viscous fiber supplementation was associated with reductions in HbA1c, fasting blood glucose and measures of insulin resistance [4]. Similarly, a 2020 systematic review and dose-response meta-analysis of psyllium supplementation reported reductions in fasting blood glucose and HbA1c among diabetic participants [5].

Psyllium is a soluble, viscous and gel-forming dietary fiber. It can increase intestinal viscosity and may slow the digestion and absorption of carbohydrate, thereby reducing postprandial glucose excursions. A 2015 meta-analysis involving randomized clinical studies reported significant improvements in fasting blood glucose and HbA1c among patients with T2DM receiving psyllium supplementation [6].

Although fiber supplementation has potential benefits, it should not be considered a substitute for a balanced diet, diabetes medication or physical activity. Nutrition therapy should emphasize food-based dietary patterns, with supplementation used selectively when it can provide additional nutritional benefit [1].

Dietary protein is another important consideration in diabetes management. However, evidence does not indicate that simply increasing protein intake produces consistent improvements in glycemic control. A systematic review of high-protein diets in T2DM found insufficient evidence for a significant overall improvement in HbA1c or fasting glucose compared with control diets [7]. Thus, protein intake should be individualized rather than increased indiscriminately.

Mediterranean-style and other nutrient-dense dietary patterns have also been studied in diabetes management. Evidence suggests that Mediterranean-style diets can have favorable effects on glycemic control and cardiovascular risk factors in people with diabetes [8]. These dietary approaches emphasize vegetables, legumes, whole grains, nuts, seeds, fish and unsaturated fats while limiting highly processed foods and added sugars.

Weight management is also important because overweight and obesity frequently coexist with T2DM. Even moderate weight loss can improve insulin sensitivity and metabolic health. The American Diabetes Association recommends individualized nutrition and lifestyle interventions to support healthy weight management in people with diabetes [2].

Despite growing evidence regarding nutrition therapy, individual responses to dietary interventions vary. Case studies can provide useful practical insights into how an individualized dietary intervention can be implemented in a real-world setting.

The present case study therefore describes the effect of a structured dietary intervention supplemented with soluble dietary fiber in a woman with T2DM. The case emphasizes the importance of integrating supplementation with medical nutrition therapy, physical activity and continued medical care.

2. AIM AND OBJECTIVES

2.1 Aim

To evaluate the effect of dietary supplementation with soluble fiber as an adjunct to individualized medical nutrition therapy in a woman with type 2 diabetes mellitus.

2.2 Objectives

The specific objectives were:

1. To assess the baseline nutritional and anthropometric status of the participant.
2. To develop an individualized dietary plan appropriate for T2DM.
3. To incorporate a soluble-fiber-containing dietary supplement into the meal plan.

4. To monitor changes in body weight, BMI and waist circumference.
5. To evaluate changes in fasting blood glucose and HbA1c.
6. To assess dietary adherence, satiety and tolerance to the supplement.
7. To evaluate the feasibility of integrating dietary supplementation into routine diabetes nutrition management.

3. MATERIALS AND METHODS

3.1 Study design

The present study was designed as a 12-week single-case nutrition intervention. The case described below is an illustrative model developed for academic and manuscript-writing purposes. The numerical data should be replaced by actual clinical and dietary measurements before submission to a journal.

3.2 Participant

The illustrative participant was a 52-year-old woman diagnosed with T2DM approximately five years earlier. She had a predominantly sedentary occupation and reported irregular meal timing, frequent consumption of refined cereal products and occasional consumption of sweets and sugar-containing beverages.

The participant was receiving stable oral antidiabetic medication prescribed by her physician. No medication changes were intentionally made during the intervention.

She reported difficulty controlling portion sizes, particularly during the evening meal, and occasionally experienced hunger between meals.

3.3 Baseline assessment

At baseline, the participant's weight was 76.8 kg and height was 158 cm. BMI was calculated using the following equation:

BMI = body weight (kg) / height² (m²)

The calculated BMI was 30.8 kg/m².

Waist circumference was 98 cm.

Baseline laboratory assessment showed:

- Fasting blood glucose: 158 mg/dL
- HbA1c: 8.1%
- Total cholesterol: 208 mg/dL
- Triglycerides: 178 mg/dL

These values were considered illustrative and should be replaced with actual laboratory results in a real case report.

3.4 Dietary assessment

A 24-hour dietary recall, food-frequency questionnaire and dietary history were used to assess the participant's usual food intake.

The baseline dietary pattern indicated:

- irregular meal timing;
- relatively high intake of refined cereals;
- inadequate intake of vegetables;
- low-to-moderate fruit intake;
- frequent consumption of fried snacks;
- occasional sweets;
- inadequate dietary fiber;
- inconsistent protein intake; and
- low levels of planned physical activity.

The participant was also consuming tea or coffee with added sugar on several occasions during the day.

3.5 Dietary intervention

An individualized meal plan providing approximately 1,500–1,600 kcal/day was developed.

The meal plan emphasized:

- non-starchy vegetables;
- whole grains and millets;
- pulses and legumes;
- moderate portions of fruit;
- low-fat dairy products;
- nuts and seeds;
- adequate protein;
- controlled portions of carbohydrate-rich foods; and
- adequate fluid intake.

Refined cereal products, sweets, sugar-sweetened beverages, deep-fried foods and highly processed snacks were minimized.

The meal plan was distributed over three major meals and two planned snacks to reduce long periods without food and improve dietary adherence.

The dietary intervention was based on the principle that there is no universal macronutrient distribution appropriate for all individuals with diabetes. Instead, carbohydrate, protein and fat intake should be individualized according to dietary preferences, metabolic goals and clinical status [1,2].

3.6 Dietary supplementation

A soluble-fiber supplement was incorporated into the intervention. For this illustrative case, the supplement was assumed to provide approximately 5 g of soluble fiber per serving.

The supplement was consumed once daily approximately 15–20 minutes before the main meal, accompanied by adequate water.

The rationale for supplementation was based on evidence suggesting that viscous soluble fiber can modestly improve glycemic control in individuals with T2DM [4,6].

The supplement was not intended to replace meals. It was used as an adjunct to the regular diet.

The participant was advised not to initiate other weight-loss products, herbal preparations or nutritional supplements during the intervention.

3.7 Physical activity

The participant was initially advised to walk for approximately 20–25 minutes on most days of the week. The duration was gradually increased to approximately 40 minutes per day, five days per week.

She was also advised to reduce prolonged sitting and incorporate short periods of walking after meals where practical.

Physical activity was included because diabetes management should not rely on dietary supplementation alone. Lifestyle interventions combining nutrition, physical activity and self-management education are central to diabetes care [2].

3.8 Monitoring and follow-up

Follow-up assessments were performed at baseline, week 4, week 8 and week 12.

The following parameters were monitored:

- body weight;
- BMI;
- waist circumference;
- fasting blood glucose;
- dietary adherence;
- physical activity;
- frequency of snacking;
- subjective satiety; and
- tolerance of the supplement.

HbA1c was assessed at baseline and at the end of the 12-week intervention.

The participant continued her prescribed diabetes medication throughout the study.

4. RESULTS

4.1 Anthropometric outcomes

The participant demonstrated progressive reductions in body weight and waist circumference during the 12-week intervention.

Parameter	Baseline	Week 4	Week 8	Week 12
Body weight (kg)	76.8	75.3	73.9	72.9
BMI (kg/m²)	30.8	30.2	29.6	29.2
Waist circumference (cm)	98	96	94	92

Body weight decreased by 3.9 kg over 12 weeks, corresponding to approximately 5.1% of the baseline body weight.

Waist circumference decreased by 6 cm.

4.2 Glycemic outcomes

A progressive improvement in fasting blood glucose was observed.

Parameter	Baseline	Week 4	Week 8	Week 12
Fasting blood glucose (mg/dL)	158	145	133	124
HbA1c (%)	8.1	—	—	7.2

Fasting blood glucose decreased by 34 mg/dL from baseline to week 12.

HbA1c decreased from 8.1% to 7.2%, representing an absolute reduction of 0.9 percentage points.

4.3 Dietary and behavioral changes

The participant demonstrated improved dietary adherence during the intervention.

She reported:

- reduction in refined carbohydrate intake;
- elimination of regular sugar-sweetened beverages;
- increased vegetable intake;
- increased consumption of pulses and whole grains;
- reduced fried-food consumption;
- improved meal regularity; and
- reduced evening snacking.

The participant also reported improved satiety after consuming the soluble-fiber supplement before the main meal.

4.4 Supplement tolerance

The supplement was generally well tolerated. Mild bloating was reported during the first few days but subsequently subsided. No severe gastrointestinal symptoms or other adverse events were reported.

Adequate fluid intake was emphasized throughout the intervention.

5. Discussion

The present case illustrates the potential role of dietary supplementation as an adjunct to individualized medical nutrition therapy in a woman with T2DM. Over 12 weeks, the participant demonstrated improvements in body weight, waist circumference, fasting blood glucose and HbA1c.

The observed reduction in HbA1c from 8.1% to 7.2% is clinically relevant; however, the result should be interpreted cautiously. The intervention involved several simultaneous components, including energy restriction, improved dietary quality, soluble-fiber supplementation, increased physical activity and behavioral modification. Therefore, it is not possible to determine the independent contribution of the fiber supplement to the observed reduction in HbA1c.

Current diabetes nutrition recommendations emphasize individualized medical nutrition therapy rather than a single standardized dietary prescription [1]. The dietary plan in this case was therefore developed according to the participant's eating habits, preferences and metabolic requirements.

5.1 Effect of dietary modification

The participant's improvement in dietary quality may have contributed substantially to the observed changes.

The intervention reduced refined carbohydrate foods and added sugars while increasing vegetables, pulses and whole grains. Such dietary changes are consistent with recommendations for people with diabetes [1,2].

A healthy dietary pattern can influence glycemic control through multiple mechanisms, including improved carbohydrate quality, increased dietary fiber, improved satiety and reduction in excessive energy intake.

The participant's reduction in evening snacking may also have contributed to the energy deficit and subsequent weight reduction.

5.2 Potential role of soluble dietary fiber

Soluble dietary fiber was selected as the dietary supplement because of its potential effects on glucose metabolism.

Viscous fibers may slow gastric emptying and carbohydrate absorption, resulting in a lower postprandial glucose

response. They may also influence appetite and subsequent energy intake.

A systematic review and meta-analysis by Jovanovski et al. found that viscous fiber supplementation was associated with significant reductions in HbA1c and fasting blood glucose in people with T2DM [4]. The median fiber dose in the included studies was approximately 13.1 g/day.

Similarly, a meta-analysis of psyllium supplementation found significant reductions in fasting blood glucose and HbA1c in diabetic patients [5]. Another meta-analysis reported that psyllium supplementation was associated with improvements in fasting blood glucose and HbA1c, particularly among individuals with poorer baseline glycemic control [6].

These findings provide a plausible rationale for incorporating soluble fiber into a diabetes nutrition intervention.

However, the quantity of fiber used in the present illustrative case was relatively modest. The intervention therefore should not be interpreted as evidence that a specific 5-g supplement independently produces the observed improvement.

5.3 Food-based fiber versus supplements

Although dietary fiber supplementation may be useful, food should remain the preferred source of fiber whenever possible.

Vegetables, fruits, legumes and whole grains provide fiber along with vitamins, minerals, phytochemicals and other bioactive compounds. The ADA consensus report recommends meeting fiber requirements primarily through naturally fiber-rich foods while recognizing that supplementation may provide additional benefit in some circumstances [1].

In the present case, supplementation was therefore used as an adjunct rather than a substitute for high-fiber foods.

5.4 Role of protein

The intervention also emphasized adequate protein intake from pulses, legumes, dairy products, nuts and seeds.

Protein can contribute to satiety and may assist with dietary adherence during energy restriction. However, high-protein diets should not be assumed to improve glycemic control independently.

A systematic review of high-protein dietary interventions in T2DM did not find significant overall improvements in fasting glucose or HbA1c compared with control diets [7].

Therefore, the emphasis in this case was on **adequate and balanced protein intake**, rather than excessive protein supplementation.

5.5 Weight reduction and glycemic control

The participant lost approximately 5.1% of her baseline body weight. Weight reduction is particularly important in individuals with T2DM who are overweight or obese.

The reduction in body weight may have contributed to improved insulin sensitivity and glycemic control.

The intervention was designed to create a modest energy deficit rather than severe calorie restriction. This approach may be more sustainable and is consistent with the principle of individualized diabetes nutrition therapy [1,2].

5.6 Physical activity

Physical activity was an important component of the intervention. The participant progressed from low levels of planned exercise to approximately 40 minutes of walking on most days.

Exercise can improve insulin sensitivity and glucose utilization independently of weight loss. Therefore, the observed improvement in glycemic control may reflect the combined effects of dietary modification, supplementation and increased physical activity.

This reinforces the importance of presenting dietary supplementation as an adjunct rather than a stand-alone diabetes treatment.

5.7 Importance of individualized nutrition therapy

A major strength of the intervention was its individualized nature.

There is no single ideal proportion of carbohydrate, protein and fat for all individuals with diabetes. Dietary recommendations should consider personal preferences, cultural practices, economic circumstances, food accessibility, medication regimen and metabolic goals [1,2].

In the present case, the participant was encouraged to continue eating culturally familiar foods while modifying portion sizes, preparation methods and carbohydrate quality.

This approach may improve long-term adherence compared with highly restrictive diets.

5.8 Comparison with previous evidence

The results of this illustrative case are broadly consistent with evidence showing that dietary fiber interventions can produce modest improvements in glycemic parameters.

An earlier systematic review reported that psyllium supplementation and low-glycemic-index dietary approaches could improve glycemic risk factors in individuals with T2DM [9].

Gibb et al. reported that psyllium supplementation improved fasting blood glucose and HbA1c in individuals with T2DM [6]. More recent evidence from 2020 similarly found significant reductions in HbA1c and fasting blood glucose following psyllium supplementation [5].

The present case therefore provides a practical example of how soluble fiber may be integrated into a broader dietary intervention.

However, case-study findings should not be interpreted as proof of efficacy. Randomized controlled trials provide stronger evidence regarding causal effects.

6. Clinical Implications

The case has several implications for nutrition and dietetics practice.

First, dietary supplementation should be incorporated only after assessment of the individual's dietary pattern and nutritional requirements.

Second, soluble-fiber supplementation may be considered for selected individuals with T2DM, particularly when dietary fiber intake is inadequate and when supplementation is clinically appropriate.

Third, supplements should not replace vegetables, fruits, legumes and whole grains.

Fourth, patients using fiber supplements should be advised to consume adequate fluid and should be monitored for gastrointestinal symptoms.

Fifth, dietary interventions should be coordinated with diabetes medication and physical activity. Changes in diet or weight may alter glycemic control and may require medication review by the treating physician.

Finally, regular monitoring of fasting glucose and HbA1c is essential for evaluating the effectiveness of diabetes management.

7. LIMITATIONS

The major limitation of this study is its single-case design. A single participant cannot represent the broader population of women with T2DM.

Because several components were introduced simultaneously, including dietary modification, physical activity and supplementation, the independent effect of the supplement cannot be determined.

The follow-up duration was only 12 weeks and therefore does not provide information about long-term sustainability.

Dietary intake was based partly on self-reported information and may therefore be affected by recall bias.

The case also did not include continuous glucose monitoring or detailed postprandial glucose measurements.

Additionally, the illustrative case does not include detailed assessment of renal function. This is important because dietary recommendations, particularly protein intake and certain supplements, should be individualized according to kidney function in people with diabetes.

8. CONCLUSION

The present case demonstrates the potential usefulness of incorporating dietary supplementation into a comprehensive nutrition intervention for a woman with type 2 diabetes mellitus.

Over a 12-week intervention, the participant showed reductions in body weight, BMI, waist circumference, fasting blood glucose and HbA1c. Dietary behavior also improved, with increased consumption of vegetables, pulses and whole grains and reduced intake of refined carbohydrate foods, fried snacks and sugar-containing beverages.

The soluble-fiber supplement may have contributed to improved satiety and glycemic control. This interpretation is biologically plausible and consistent with systematic reviews reporting modest improvements in HbA1c and fasting blood glucose following viscous or soluble fiber supplementation [4-6].

Nevertheless, the improvements observed in this case cannot be attributed solely to supplementation because the intervention included several components. The most appropriate interpretation is that **dietary supplementation may serve as a useful adjunct to individualized medical nutrition therapy, rather than as an independent treatment for diabetes**.

Future controlled studies with larger samples, longer follow-up, standardized supplement doses and detailed dietary and biochemical assessments are required to establish the specific contribution of dietary supplementation to diabetes management.

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