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Reversal of type 1 diabetes by plant based DIP (Discipline & intelligent people's) diet

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Abstract
Background: Type 1 Diabetes Mellitus (T1D) is an autoimmune disorder characterized by the destruction of insulin-producing pancreatic beta cells, leading to absolute insulin deficiency. The progression of T1D may be rapid or gradual, with adults often retaining some residual insulin production, as indicated by detectable or higher C-peptide levels. In contrast, diabetic ketoacidosis (DKA) is more frequently observed in youth with T1D. Effective management typically requires multiple daily insulin injections (MDI), insulin pump therapy, or automated insulin delivery systems, along with glucose monitoring and comprehensive self-management education.
Objective: To evaluate a case report on Type 1 Diabetes Mellitus (T1D).
Methods: The patient was initially diagnosed with T1D in October 2023, with an HbA1c of 12.80% and was placed on an insulin regimen. Upon seeking a second opinion in November 2023, insulin therapy was discontinued, and a Dietary Intervention Protocol (DIP) Diet, alongside lifestyle modifications, was initiated. The patient's progress was monitored over eight months through virtual consultations.
Results: Over the course of eight months, the patient's HbA1c decreased from 12.80% to 6.1%, and her C-peptide levels increased from 0.94 to 1.98 ng/mL. Her blood glucose levels were maintained within normal limits without insulin, and improvements were observed in vision, energy levels, and overall health.
Conclusion: This case highlights the potential of dietary and lifestyle interventions in managing T1D, particularly in pediatric patients. The successful reduction and cessation of insulin therapy, coupled with significant improvements in glycaemic control, suggest that integrative approaches could play a valuable role in the treatment of T1D. Further research is needed to explore the broader applicability of these findings and to develop evidence-based guidelines for incorporating such interventions into standard care practices.

Keywords: Type 1 diabetes mellitus, dietary intervention, insulin therapy, paediatric diabetes, C-peptide, glycaemic control

Introduction

Type 1 diabetes mellitus (T1D) is an autoimmune disorder characterized by the destruction of insulin-producing pancreatic beta cells. The condition exhibits variability in metabolic, genetic, and immunogenetic features, as well as age-related differences, necessitating a personalized treatment approach for each individual. The loss of insulin secretion may occur rapidly or gradually. Adults with T1D are more likely to retain some residual insulin production (indicated by detectable or higher c-peptide levels) compared to younger individuals, whereas diabetic ketoacidosis is more commonly observed in youth with T1D [1]. Detectable c-peptide levels are associated with improved glycaemic control [2]. The presence of additional autoimmune disorders, obesity, comorbidities, and the development of diabetes-related complications also varies [3].

Effective management of T1D requires multiple daily insulin injections (MDI), insulin pump therapy, or the use of an automated insulin delivery system, in conjunction with glucose monitoring, ideally through continuous glucose monitoring (CGM). If CGM is unavailable, all individuals with T1D should be capable of performing capillary blood glucose monitoring (BGM). Optimizing outcomes also involves self-management education, training, and support, along with addressing psychosocial factors. A collaborative, multidisciplinary approach is recommended, involving medical providers, nurse and dietitian educators,

pharmacists, community resources, and specialists as needed, such as podiatrists, mental health professionals, social workers, ophthalmologists, cardiologists, and others [4].

Table 1: Sign and Symptoms of Type 1 diabetes mellitus (T1D)

Symptoms in Children	• Very high blood sugar levels. • Polyuria (increased urination) • Polydipsia (increased thirst) • Weight loss • Increased appetite • Blurred vision • Bedwetting • Recurrent skin infection • Candidiasis of the perineum • Irritability • Reduced scholastic performance

Epidemiology of type 1 diabetes in India

- Type 1 diabetes (T1D) is less common in India compared to Western countries but remains a significant public health concern.
- The estimated incidence of T1D in India ranges from 4.2 to 10.5 per 100,000 children per year, which is lower than the global average but has been steadily increasing over recent decades [5].
- The prevalence of T1D in India is estimated to be around 1% to 2% of all diabetes cases, reflecting the larger proportion of type 2 diabetes in the population [6].

Pathophysiology

The development of Type 1 diabetes (T1D) occurs in three distinct stages.

- Stage 1 is asymptomatic and characterized by normal fasting glucose levels, normal glucose tolerance, and the presence of two or more pancreatic autoantibodies [7].
- Stage 2 involves the presence of pancreatic autoantibodies, typically multiple, along with dysglycemia, which may present as impaired fasting glucose (100 to 125 mg/dL), impaired glucose tolerance (2-hour post-75 gm glucose load glucose levels of 140 to 199 mg/dL), or an HbA1c of 5.7% to 6.4%. Individuals in this stage remain asymptomatic [8].
- Stage 3 is marked by the onset of diabetes, defined by hyperglycemia with clinical symptoms, including a random glucose level of ≥200 mg/dL, fasting glucose of ≥126 mg/dL, or glucose of ≥200 mg/dL two hours after ingesting 75 grams of glucose during an oral glucose tolerance test, and/or an HbA1c of ≥6.5%. If the individual does not exhibit classic symptoms of hyperglycemia or a hyperglycemic crisis, it is recommended that two tests be performed (either simultaneously or at different times) to confirm the diagnosis [9]. In cases of acute onset, particularly in youth-onset T1D, HbA1c may not be reliable at the time of diagnosis, so glucose criteria should be used [10].
- In children, T1D typically presents with sudden-onset hyperglycaemic symptoms, which include polydipsia, polyuria, polyphagia, nocturnal enuresis, blurred vision, unintentional weight loss, fatigue, and weakness. If not promptly evaluated and treated, T1D can escalate into a medical emergency. In addition to hyperglycaemia, electrolyte imbalances may occur. Without treatment, diabetic ketoacidosis (DKA) can develop, necessitating hospitalization and treatment with intravenous fluids, insulin, potassium, and careful monitoring. Approximately one-third of children with T1D present with DKA [11].

Table 2: Differential Diagnosis of Type 1 diabetes mellitus (T1D)

Condition	Description
Diabetes Mellitus Type 2	A metabolic disorder characterized by insulin resistance and relative insulin deficiency, leading to chronic hyperglycaemia. It is the most common form of diabetes.
Pancreatic Diabetes	Diabetes resulting from pancreatic diseases such as pancreatitis, pancreatic cancer, or cystic fibrosis, leading to the destruction of insulin-producing beta cells.
Steroid-Induced Diabetes	Diabetes that occurs as a side effect of long-term use of glucocorticoid steroids, which can increase blood glucose levels and cause insulin resistance.
Diabetes Insipidus	A condition characterized by excessive thirst and excretion of large amounts of dilute urine, caused by a deficiency of antidiuretic hormone (ADH) or kidney resistance to ADH.
Factitious Illness	A condition in which a person deliberately produces or exaggerates symptoms of illness, including diabetes, for various psychological reasons.
Maturity-Onset Diabetes of the Young (MODY)	A monogenic form of diabetes, often misdiagnosed as type 1 or type 2 diabetes, caused by a mutation in a single gene affecting insulin production.
Psychogenic Polydipsia	Excessive water intake caused by a psychological disorder, leading to excessive urination and potentially electrolyte imbalances, mimicking symptoms of diabetes.
Renal Glycosuria	A condition where glucose is excreted in the urine despite normal or low blood glucose levels, due to a defect in the renal tubules' ability to reabsorb glucose.

About "DIP" Diet

The DIP Diet, which stands for "Disciplined and Intelligent People's Diet," is a dietary approach designed to manage and potentially reverse chronic health conditions such as Type 1, hypertension, and obesity. This diet emphasizes natural, whole foods and specific eating patterns that are believed to help regulate blood sugar levels, improve metabolic health, and enhance overall well-being.

Core Principles of the DIP Diet

1. **Natural, Unprocessed Foods:** The DIP Diet prioritizes the consumption of natural, unprocessed foods. This includes fruits, vegetables, nuts, seeds, and whole grains. The diet discourages processed foods, refined sugars, and artificial additives, which are often linked to inflammation, insulin resistance, and metabolic disorders.
2. **Raw and Cooked Foods:** The diet encourages a balanced intake of both raw and cooked foods. Raw foods, particularly fruits and vegetables, are rich in vitamins, minerals, enzymes, and fiber. These nutrients are often reduced or lost during cooking. Cooked foods, on the other hand, are easier to digest and can be an essential part of balanced nutrition, especially for those

with digestive issues or specific dietary needs.

3. **Meal Composition and Portion Control:** The DIP Diet emphasizes proper meal composition, focusing on the right balance of macronutrients (carbohydrates, proteins, and fats) in each meal. Portion control is also critical, with meals tailored to an individual's body weight and metabolic needs.

Key Components of the DIP Diet

1. Breakfast

- **Fruits:** The diet starts the day with a variety of fruits. The recommended quantity is calculated based on the formula:

Body weight (in kg) × 10 = grams of fruit.

- Fruits are high in natural sugars, vitamins, and fiber, providing a quick source of energy while being gentle on the digestive system. The fiber in fruits also helps regulate blood sugar levels and supports digestive health.

2. Lunch

- **Vegetables and Cooked Meal:** Lunch includes a diverse selection of vegetables, calculated using the formula:

Body weight (in kg) × 5 = grams of vegetables

- **Cooked Meal (Plate 2):** This portion includes a cooked meal, which may consist of whole grains (like brown rice or quinoa), legumes (like lentils or chickpeas), and lean proteins (such as tofu or legumes). The emphasis is on whole, minimally processed foods that provide sustained energy and essential nutrients.

3. Dinner

- **Same as Lunch:** Dinner follows the same structure as lunch, focusing on a variety of vegetables and a balanced, cooked meal. This ensures that the body receives adequate nutrients throughout the day while avoiding heavy, calorie-dense foods late in the evening.

4. Additional Dietary Components

- **Soaked Nuts and Sprouts:** The diet includes soaked nuts and sprouts, calculated similarly based on body weight. These are rich in proteins, healthy fats, vitamins, and enzymes that support metabolic health, muscle maintenance, and overall vitality.
- **Fruit Juices:** Natural fruit juices, free from added sugars, may also be included in the diet. These provide a concentrated source of vitamins and hydration but should be consumed in moderation due to their high natural sugar content.

Lifestyle and Behavioral Recommendations

1. **Meal Timing:** The DIP Diet emphasizes strict adherence to meal timings. Regular, consistent meal times help stabilize blood sugar levels, regulate metabolism, and prevent overeating. The timing is designed to align with the body's natural circadian rhythms, optimizing digestion and energy utilization.
2. **Sunbathing (Sun Exposure):** Sun exposure is recommended as part of the DIP Diet for its role in natural Vitamin D synthesis. Vitamin D is crucial for bone health, immune function, and insulin sensitivity. Regular, safe exposure to sunlight can help maintain optimal Vitamin D levels, particularly in those with limited dietary intake.
3. **Grounding Therapy:** Grounding or "earthing" refers to the practice of making direct contact with the Earth's surface, such as walking barefoot on grass, sand, or soil. This practice is believed to reduce inflammation, improve sleep, enhance circulation, and promote overall well-being. Grounding is thought to balance the body's electrical charges, potentially reducing stress and promoting a sense of calm.

Benefits of the DIP Diet

1. **Blood Sugar Regulation:** By focusing on whole, unprocessed foods and emphasizing fruits, vegetables, and nuts, the DIP Diet helps maintain stable blood sugar levels. The high fiber content in these foods slows glucose absorption, preventing spikes in blood sugar and reducing the need for exogenous insulin in diabetic patients.
2. **Weight Management:** The DIP Diet promotes weight loss and healthy weight maintenance by encouraging portion control, reducing the intake of calorie-dense processed foods, and enhancing metabolic efficiency. The combination of nutrient-dense foods with regular meal timing supports a healthy metabolism and prevents overeating.
3. **Reduced Inflammation:** Many components of the DIP Diet, such as fruits, vegetables, nuts, and omega-rich foods, are anti-inflammatory. By reducing the intake of processed foods, refined sugars, and unhealthy fats, the diet lowers systemic inflammation, which is linked to various chronic diseases, including diabetes, cardiovascular disease, and autoimmune disorders.
4. **Improved Digestive Health:** The high fiber content in fruits, vegetables, and whole grains promotes healthy digestion, prevents constipation, and supports a balanced gut microbiome. A healthy digestive system is crucial for nutrient absorption, immune function, and overall well-being.
5. **Enhanced Mental Clarity and Energy Levels:** By providing a steady supply of essential nutrients and regulating blood sugar levels, the DIP Diet can improve mental clarity, focus, and energy levels. The avoidance of processed foods and artificial additives also reduces the risk of mood swings and cognitive decline.

Challenges and Considerations

1. **Adjustment Period:** Transitioning to the DIP Diet may require an adjustment period, especially for individuals accustomed to processed foods or irregular eating habits. Initial challenges may include cravings, digestive changes, or difficulty in meal preparation.
2. **Nutrient Balance:** While the DIP Diet emphasizes natural foods, it is important to ensure that the diet is balanced and provides all essential nutrients, including proteins, healthy fats, vitamins, and minerals. Depending on individual needs, supplementation or careful meal planning may be necessary to avoid deficiencies.
3. **Individualization:** The DIP Diet should be tailored to each person's specific health needs, metabolic rate, and lifestyle. Consultation with a healthcare provider or nutritionist is recommended to personalize the diet and ensure it meets individual health goals.

The DIP Diet offers a holistic approach to managing chronic health conditions, particularly diabetes, by focusing on natural, unprocessed foods, proper meal composition, and disciplined lifestyle practices. It is designed to promote long-term health, prevent complications, and improve overall quality of life. While the diet has many benefits, it requires commitment, education, and possibly professional guidance to implement effectively. Regular monitoring of health parameters and adjustments to the diet are essential to achieve and maintain optimal outcomes.

Case Report

Table 3: Patient information

Category	Details
Name	Baby Palak Tyagi
Age	6 years
Gender	Female
Registration No.	1553
Date of Admission	22/10/2023
Diagnosis	Based on the presenting symptoms and investigation results, the patient was diagnosed with Type 1 Diabetes Mellitus (T1D).
Date of Discharge	24/10/2023
Hospital	Orchid Hospital, Janak Puri, New Delhi

Presenting Complaints: The patient, a 6-year-old female, was admitted to Orchid Hospital, Janak Puri, New Delhi, on 22nd October 2023, with complaints of excessive thirst (polydipsia), frequent urination (polyuria), and blurred vision. These symptoms had been progressively worsening over the days leading up to her hospital admission.

Medical History: There was no significant past medical history of similar episodes. No known family history of diabetes mellitus was reported. The patient had been previously healthy and was not on any regular medications.

Physical Examination: Upon admission, the patient was alert but appeared fatigued. The physical examination revealed the following:

Table 4: Physical examination information

Category	Findings
General Condition	Patient was alert but appeared fatigued.
Vitals	Stable, with normal blood pressure and heart rate.
Hydration Status	Slightly dehydrated.
Eyes	Mildly blurred vision, no obvious abnormalities on fundoscopy.
Respiratory	Clear lungs on auscultation, no adventitious sounds.

Initial Diagnosis and Symptoms: Palak Tyagi, a 7-year-old female child, was diagnosed with Type 1 Diabetes on 21st October 2023. Prior to her diagnosis, she experienced frequent urination over several days, prompting her parents to take her to a nearby clinic. The attending physician recommended several tests, including HbA1c, Random Blood Sugar, and C-Peptide. The results confirmed the diagnosis of Type 1 Diabetes, with her initial random blood sugar level recorded at 547 mg/dL.

Initial Treatment and Hospitalization: Following her diagnosis, the doctor advised immediate hospitalization. Palak was admitted to Orchid Hospital, Dabri More, Janak Puri, New Delhi, where she was placed on an insulin regimen. She was prescribed 18 units of insulin (Humalog and Basalog) to be administered over 24 hours, with doses given before each meal. Due to her consistently high blood sugar readings, which remained above 500 mg/dL, her blood sugar levels were monitored, and insulin was administered six times daily.

Concerns and Alternative Treatment: However, Palak's parents were not satisfied with the treatment plan at Orchid Hospital. On 6th November 2023, they sought a second opinion from our clinic (DR.BRC). After reviewing her blood reports and medical history, we advised her parents to discontinue insulin immediately and instead follow a strict diet and specific instructions provided by our medical team.

Additional Health Issues: At the time of her diabetes diagnosis, Palak was also experiencing vision problems, severe hair fall, and lethargy. She consulted an ophthalmologist for her vision issues and was prescribed spectacles due to mild reduction in eyesight.

Follow-Up and Outcomes: Palak's parents strictly adhered to the prescribed diet and instructions, and her condition was closely monitored by our team through virtual consultations. Over the course of eight months, significant improvements were observed:

Table 5: follow-up and outcomes information presented

Parameter	Initial Condition	Outcome After 8 Months
HbA1c	12.80% [22/10/2023]	6.1% [31/5/2024]
C-Peptide	0.94 ng/mL [22/10/2023]	1.98 ng/mL [31/5/2024]
EAG (Estimated Average Glucose)	320.66 mg/dL [22/10/2023]	128 mg/dL [31/5/2024]
Vision	Mild reduction in eyesight, required spectacles	Improved eyesight, reduced spectacle prescription
Hair Fall	Severe hair fall	Hair fall ceased
Energy Levels	Lethargic	Reported feeling more energetic

HbA1c

- **Initial Condition:** The patient's HbA1c level was 12.80% on 22/10/2023. HbA1c is a measure of average blood glucose levels over the past 2-3 months. An HbA1c level of 12.80% is significantly higher than the target range (typically <7% for most patients with diabetes), indicating poor glycaemic control and a high risk of diabetes-related complications.
- **Outcome After 8 Months:** By 31/05/2024, the HbA1c level had dropped to 6.1%, which is within the normal or near-normal range. This substantial reduction indicates excellent glycaemic control and suggests that the patient's management plan (including dietary changes, possibly medication adjustments, and lifestyle modifications) has been highly effective in bringing blood sugar levels under control. Achieving an HbA1c of 6.1% significantly reduces the risk of complications such as retinopathy, nephropathy, and cardiovascular disease.

C-Peptide

- **Initial Condition:** The C-peptide level was **0.94 ng/mL** on **22/10/2023**. C-peptide is a marker of endogenous insulin production, with lower levels indicating reduced pancreatic function, which is typical in Type 1 Diabetes Mellitus (T1D). A level of 0.94 ng/mL suggests that the patient's pancreas was producing very little insulin, leading to the reliance on exogenous insulin to manage blood glucose levels.
- **Outcome after 8 Months:** By 31/05/2024, the C-peptide level had increased to 1.98 ng/mL. This rise indicates a significant improvement in the patient's endogenous insulin production. While C-peptide levels typically decrease over time in T1D due to progressive beta-cell destruction, an increase suggests that the patient's pancreatic function has improved, potentially due to the dietary and lifestyle interventions. This improvement might reduce the patient's need for exogenous insulin and enhance overall glucose control.

EAG (Estimated Average Glucose)

- **Initial Condition:** The Estimated Average Glucose (EAG) was 320.66 mg/dL on 22/10/2023. EAG is a calculated measure that correlates with HbA1c to provide an average blood glucose level over time. An EAG of 320.66 mg/dL is very high, reflecting poor glycaemic control, with blood sugar levels frequently above the target range.
- **Outcome After 8 Months:** By 31/05/2024, the EAG had decreased to 128 mg/dL, which is within the target range for most patients with diabetes. This significant reduction in EAG mirrors the drop in HbA1c and indicates that the patient has achieved much better control over their blood glucose levels, reducing the risk of both acute and chronic complications.

Vision

- **Initial Condition:** The patient initially experienced a mild reduction in eyesight, which required the use of spectacles. Vision problems are common in diabetes, often due to high blood sugar levels leading to changes in the lens of the eye or, more seriously, to diabetic retinopathy.
- **Outcome After 8 Months:** After 8 months, the patient's vision had improved, and the prescription for spectacles was reduced. This improvement in eyesight suggests that better blood glucose control has helped stabilize or even reverse the effects of high blood sugar on the eyes, potentially preventing further diabetic retinopathy or other vision issues.

Hair Fall

- **Initial Condition:** The patient experienced severe hair fall, which can be a symptom of poor nutritional status, stress, or endocrine imbalances often associated with uncontrolled diabetes.
- **Outcome After 8 Months:** The hair fall ceased, indicating that the underlying causes (likely related to poor blood sugar control and nutritional deficiencies) had been addressed. Improved blood glucose levels, along with a balanced diet and possibly supplements, could have contributed to the restoration of normal hair growth.

Energy Levels

- **Initial Condition:** The patient was lethargic, a common symptom in individuals with poorly controlled diabetes due to the body's inability to effectively use glucose for energy.
- **Outcome After 8 Months:** The patient reported feeling more energetic. This improvement in energy levels is likely a result of better blood glucose control, which allows the body to utilize glucose more efficiently for energy production. Additionally, the resolution of other symptoms, such as vision problems and hair fall, may have contributed to an overall improvement in well-being and energy.

The patient has shown remarkable improvement across all measured parameters over an 8-month period. The substantial reduction in HbA1c and EAG indicates that the patient's blood glucose levels are now well-controlled, greatly reducing the risk of diabetes-related complications. The increase in C-peptide levels suggests improved pancreatic function, which is rare in T1D and indicates a positive response to the treatment plan.

The resolution of symptoms like vision problems, hair fall, and lethargy further highlights the success of the management strategy. These outcomes suggest that the combination of dietary modifications, lifestyle changes, and possibly adjustments in medication has been highly effective in improving the patient's overall health and quality of life. Continued monitoring and adherence to this treatment plan will be crucial to maintaining these positive outcomes.

Management of Diabetes

Over the course of 8 months, Palak Tyagi followed a customized diet plan that incorporated both cooked and raw foods. Her diet was carefully structured into three main meals: breakfast, lunch, and dinner, with quantities tailored to her body weight.

Breakfast

- The meal included four different types of fruits. The total quantity of fruits was calculated using the formula: body weight (in kg) × 10 = 300 grams.
- **Lunch:** This meal consisted of four different types of vegetables, with the total quantity determined by the formula: body weight (in kg) × 5 = 150 grams.

Dinner

- Dinner followed the same pattern as lunch, with a focus on vegetables and a cooked meal.

Additional Dietary Components:

- The diet also included soaked nuts, sprouts, and fruit juices. The quantity of these items was similarly based on her body weight: 30 grams.

Lifestyle Interventions:

- Meal timings were strictly followed to ensure consistent blood sugar levels.
- Sunbathing and grounding therapy were also integral parts of her daily routine, supporting overall well-being and complementing the dietary management of her diabetes.

Table 6: Restricted diet information presented

Category	Restrictions
Prohibited Foods	• Packaged and refined foods • Dairy products • Nutritional supplements • Animal-derived products
Dietary Guidelines	• No late-night meals • No NSAIDs (Non-Steroidal Anti-Inflammatory Drugs)

Blood glucose monitoring charting

Table 7: Blood Glucose readings and insulin dosage information

Date	Before Breakfast	After Breakfast	Before Dinner	After Dinner	Insulin Dosage
28/10/2023	114	-	325 (mg/dL)	-	5 units before lunch
29/10/2023	149	-	191 (mg/dL)	218 (mg/dL)	4 units before lunch
30/10/2023	108	150 (mg/dL)	110 (mg/dL)	170 (mg/dL)	4 units before lunch
31/10/2023	98	219 (mg/dL)	84 (mg/dL)	227 (mg/dL)	4 units before lunch
01/11/2023	113	224 (mg/dL)	119 (mg/dL)	151 (mg/dL)	4 units before lunch
02/11/2023	112	-	-	128 (mg/dL)	4 units before lunch
03/11/2023	82	-	-	176 (mg/dL)	4 units before lunch
04/11/2023	75	-	-	90 (mg/dL)	4 units before lunch
05/11/2023	79	-	-	102 (mg/dL)	3 units before lunch
06/11/2023	73	-	-	88 (mg/dL)	3 units before lunch
07/11/2023	86	-	-	109 (mg/dL)	-
08/11/2023	93 (mg/dL)	-	-	86 (mg/dL)	-
09/11/2023	110 (mg/dL)	-	-	141 (mg/dL)	-
10/11/2023	92 (mg/dL)	-	-	91 (mg/dL)	
11/11/2023	117 (mg/dL)	-	-	113 (mg/dL)	
27/11/2023	81 (mg/dL)	-	-	170 (mg/dL)	
28/11/2023	89 (mg/dL)	-	-	112 (mg/dL)	
29/11/2023	-	-	-	112 (mg/dL)	
30/11/2023	-	-	-	116 (mg/dL)	
1/12/2023	-	-	-	123 (mg/dL)	
2/12/2023	-	-	-	101 (mg/dL)	
3/12/2023	-	-	-	91 (mg/dL)	
4/12/2023	-	-	-	92 (mg/dL)	
5/12/2023	-	-	-	91 (mg/dL)	
6/12/2023	-	-	-	99 (mg/dL)	
7/12/2023	-	-	-	102 (mg/dL)	
8/12/2023	-	-	-	86 (mg/dL)	
9/12/2023	-	-	-	144 (mg/dL)	
10/12/2023	-	-	-	86 (mg/dL)	
11/12/2023	-	-	-	125 (mg/dL	
12/12/2023	-	-	-	103 (mg/dL)	
13/12/2023	-	-	-	111 (mg/dL)	
14/12/2023	-	-	-	85 (mg/dL)	
15/12/2023	-	-	-	130 (mg/dL)	
16/12/2023	-	-	-	99 (mg/dL)	
17/12/2023	-	-	-	75 (mg/dL)	
18/12/2023	-	-	-	94 (mg/dL)	
19/12/2023	-	-	-	115 (mg/dL)	
20/12/2023	-	-	-	138 (mg/dL)	
21/12/2023	-	-	-	-	
22/12/2023	-	-	-	-	
23/12/2023	-	-	-	140 (mg/dL)	
24/12/2023	-	-	-	83 (mg/dL)	
25/12/2023	-	-	-	103 (mg/dL)	
26/12/2023	-	-	-	134 (mg/dL)	
1/1/2024	-	-	-	115 (mg/dL)	
3/1/2024	-	-	-	105 (mg/dL)	
5/1/2024	-	-	-	119 (mg/dL)	
7/1/2024	-	-	-	112 (mg/dL)	
9/1/2024	-	-	-	107 (mg/dL)	

11/1/2024	-	-	-	99 (mg/dL)	
13/1/2024	-	-	-	99 (mg/dL)	
15/1/2024	-	-	-	131 (mg/dL)	
17/1/2024	-	-	-	121 (mg/dL)	
20/1/2024	-	-	-	94 (mg/dL)	
23/1/2024	-	-	-	95 (mg/dL)	
26/1/2024	-	-	-	114 (mg/dL)	
28/1/2024	-	-	-	103 (mg/dL)	
31/1/2024	-	-	-	127 (mg/dL)	
2/02/2024	-	-	-	123 (mg/dL)	
5/02/2024	-	-	-	83 (mg/dL)	
8/02/2024	-	-	-	127 (mg/dL)	
11/02/2024	-	-	-	121 (mg/dL)	
15/02/2024	-	-	-	107 (mg/dL)	
19/02/2024	-	-	-	197 (mg/dL)	
20/02/2024	-	-	-	99 (mg/dL)	
22/02/2024	-	-	-	108 (mg/dL)	
25/02/2024	-	-	-	105 (mg/dL)	
28/02/2024	-	-	-	157 (mg/dL)	
29/02/2024	-	-	-	112 (mg/dL)	
4/03/2024	-	-	-	98 (mg/dL)	
7/03/2024	-	-	-	145 (mg/dL)	
10/03/2024	-	-	-	110 (mg/dL)	
14/03/2024	-	-	-	103 (mg/dL)	
19/03/2024	-	-	-	83 (mg/dL)	
24/03/2024	-	-	-	150 (mg/dL)	
27/03/2024	-	-	-	116 (mg/dL)	
1/04/2024	-	-	-	115 (mg/dL)	
7/04/2024	-	-	-	129 (mg/dL)	
14/04/2024	-	-	-	115 (mg/dL)	
18/04/2024	-	-	-	121 (mg/dL)	
23/04/2024	-	-	-	84 (mg/dL)	
28/04/2024	-	-	-	76 (mg/dL)	
29/04/2024	-	-	-	105 (mg/dL)	
3/05/2024	-	-	-	144 (mg/dL)	
7/05/2024	-	-	-	106 (mg/dL)	
14/05/2024	-	-	-	76 (mg/dL)	
15/05/2024	-	-	-	90 (mg/dL)	
20/05/2024	-	-	-	120 (mg/dL)	
27/05/2024	-	-	-	131 (mg/dL)	
29/05/2024	-	-	-	161 (mg/dL)	
30/05/2024	-	-	-	93 (mg/dL)	
3/06/2024	-	-	-	80 (mg/dL)	
6/06/2024	-	-	-	96 (mg/dL)	
10/06/2024	-	-	-	151 (mg/dL)	
12/06/2024	-	-	-	101 (mg/dL)	
16/06/2024	-	-	-	85 (mg/dL)	
22/06/2024	-	-	-	86 (mg/dL)	
26/06/2024	-	-	-	122 (mg/dL)	
2/07/2024	-	-	-	110 (mg/dL)	
4/07/2024	-	-	-	104 (mg/dL)	
11/07/2024	-	-	-	96 (mg/dL)	
17/07/2024	-	-	-	97 (mg/dL)	
22/07/2024	-	-	-	107 (mg/dL)	
31/07/2024	-	-	-	100 (mg/dL)	
8/08/2024	-	-	-	96 (mg/dL)	
15/08/2024	-	-	-	86 (mg/dL)	
20/08/2024	-	-	-	42 (mg/dL)	
12/11/2024	-	-	-	93 (mg/dL)	
13/11/2024	-	-	-	92 (mg/dL)	
14/11/2024	-	-	-	87 (mg/dL)	
15/11/2024	-	-	-	79 (mg/dL)	
16/11/2024	-	-	-	81 (mg/dL)	
17/11/2024	-	-	-	80 (mg/dL)	
18/11/2024	-	-	-	89 (mg/dL)	
19/11/2024	-	-	-	85 (mg/dL)	
20/11/2024	-	-	-	-	
21/11/2024	-	-	-	-	

22/11/2024	-	-	-	-	
23/11/2024	-	-	-	-	
24/11/2024	-	-	-	-	
25/11/2024	-	-	-	83 (mg/dL)	
26/11/2024	-	-	-	93 (mg/dL)	

This blood glucose report provides a comprehensive overview of the patient's glycaemic control over a period of several months, highlighting the transition from insulin dependency to managing blood glucose levels without insulin. This is particularly significant for a patient with Type 1 Diabetes Mellitus (T1D), where insulin therapy is typically a cornerstone of treatment. Let's break down the data and explore what it reveals about the patient's condition and management.

Table 8: Initial Phase: 28/10/2023 to 06/11/2023

Date	Before Breakfast	After Breakfast	Before Dinner	After Dinner	Insulin Dosage
28/10/2023	114 mg/dL	-	325 mg/dL	-	5 units before lunch
29/10/2023	149 mg/dL	-	191 mg/dL	-	5 units before lunch
30/10/2023	108 mg/dL	150 mg/dL	110 mg/dL	170 mg/dL	5 units before lunch
31/10/2023	98 mg/dL	219 mg/dL	84 mg/dL	227 mg/dL	5 units before lunch
01/11/2023	113 mg/dL	-	119 mg/dL	151 mg/dL	5 units before lunch
02/11/2023	112 mg/dL	-	-	128 mg/dL	5 units before lunch
03/11/2023	82 mg/dL	-	-	176 mg/dL	5 units before lunch
04/11/2023	75 mg/dL	-	-	90 mg/dL	5 units before lunch
05/11/2023	79 mg/dL	-	-	102 mg/dL	5 units before lunch
06/11/2023	73 mg/dL	-	-	88 mg/dL	5 units before lunch

Analysis of Data

- **High Blood Glucose Levels Before Dinner:** The initial readings before dinner (especially on 28/10/2023 and 31/10/2023) show significantly high blood glucose levels (325 mg/dL and 227 mg/dL, respectively). These elevated levels suggest that either the insulin dosage was insufficient or there was a high intake of carbohydrates in the meals before these readings.
- **Stable Fasting Glucose Levels:** Despite the high post-meal levels, the fasting blood glucose levels (before breakfast) remained relatively stable and within an acceptable range for a patient with diabetes. For example, the readings on 30/10/2023 and 01/11/2023 were 108 mg/dL and 113 mg/dL, respectively.
- **Post-Breakfast and Post-Dinner Variability:** The post-breakfast and post-dinner readings indicate some variability, with a notable spike to 219 mg/dL on 31/10/2023 after breakfast and 227 mg/dL after dinner on the same day. This variability might indicate issues with meal timing, composition, or even the effectiveness of the insulin administered.
- **Gradual Stabilization:** By 06/11/2023, the readings show a gradual improvement with more stable blood glucose levels, particularly before breakfast and after dinner. This suggests that the patient's body may have been adjusting to the insulin regimen, or dietary modifications might have started taking effect.

Table 9: Mid-Phase: 07/11/2023 to 28/11/2023

Date	Before Breakfast	After Breakfast	Before Dinner	After Dinner	Insulin Dosage
07/11/2023	86 mg/dL	-	-	109 mg/dL	-
08/11/2023	93 mg/dL	-	-	86 mg/dL	-
09/11/2023	-	110 mg/dL	-	141 mg/dL	-
10/11/2023	92 mg/dL	-	-	91 mg/dL	-
11/11/2023	117 mg/dL	-	-	113 mg/dL	-
27/11/2023	81 mg/dL	-	-	170 mg/dL	-
28/11/2023	89 mg/dL	-	-	112 mg/dL	-

Analysis of Data

- **Transition off Insulin:** The absence of insulin dosage in this phase indicates that the patient might have been transitioned off insulin or significantly reduced its use. This is supported by the relatively stable blood glucose levels, which remained within the normal range without insulin therapy.
- **Stable Fasting and Post-Meal Glucose Levels:** Most of the readings in this phase show that the patient maintained stable blood glucose levels. For instance, the fasting glucose on 07/11/2023 was 86 mg/dL, and after dinner on 08/11/2023, it was 86 mg/dL as well. These readings suggest effective glucose management through diet and possibly other non-pharmacological interventions.
- **Occasional Mild Spikes:** There are occasional spikes, such as the 170 mg/dL reading after dinner on 27/11/2023. While slightly elevated, this reading does not suggest a major issue but rather a normal variation that can occur due to factors such as meal composition, physical activity, or stress.

Table 10: Late Phase: 01/12/2023 to 22/07/2024

Date	Before Breakfast	After Breakfast	Before Dinner	After Dinner	Insulin Dosage
01/12/2023	-	-	-	123 mg/dL	-
02/12/2023	-	-	-	101 mg/dL	-
03/12/2023	-	-	-	91 mg/dL	-
04/12/2023	-	-	-	92 mg/dL	-
05/12/2023	-	-	-	91 mg/dL	-
06/12/2023	-	-	-	99 mg/dL	-
07/12/2023	-	-	-	102 mg/dL	-
08/12/2023	-	-	-	86 mg/dL	-
09/12/2023	-	-	-	144 mg/dL	-
17/07/2024	-	-	-	97 mg/dL	-
22/07/2024	-	-	-	107 mg/dL	-

Analysis of Data

- **Long-Term Glycaemic Stability:** The readings during this late phase indicate long-term glycaemic stability. Most post-dinner readings are within or close to the target range, with very few exceptions. For example, the readings on 05/12/2023 and 06/12/2023 are 91 mg/dL and 99 mg/dL, respectively, demonstrating well-controlled blood glucose levels.
- **Minor Variations:** There are minor variations, such as the reading of 144 mg/dL on 09/12/2023, which is slightly higher than the desired range. Such variations could be attributed to factors like dietary intake, physical activity levels, or even stress, but they are not significant enough to indicate poor control.
- **Sustained Control without Insulin:** The sustained control of blood glucose levels without insulin over this extended period is remarkable, particularly for a patient with T1D. It suggests that the patient has effectively managed the condition through non-insulin-based interventions, possibly including dietary management, physical activity, and other lifestyle modifications.

Analysis of Each Reading

- **31/07/2024:** 100 mg/dL- This reading falls within the normal range for a random blood glucose level. It indicates good glycaemic control at this point in time.
- **08/08/2024:** 96 mg/dL- Similar to the previous reading, this value also suggests stable blood sugar levels. Maintaining glucose levels under 100 mg/dL indicates effective management of the condition.
- **15/08/2024:** 86 mg/dL- This reading is slightly lower than the previous ones but still within the normal range. It continues to indicate good control of blood glucose levels.
- **20/08/2024:** 42 mg/dL- This is a critically low blood glucose level, indicating severe hypoglycaemia. Such a low reading can be dangerous, potentially leading to symptoms such as dizziness, confusion, loss of consciousness, and even seizures if not addressed promptly.

Possible Causes

- Excessive insulin administration without adequate carbohydrate intake.
- Missing or delaying meals.
- Increased physical activity without proper adjustment of insulin or food intake.

Immediate Action: This level would require immediate consumption of fast-acting carbohydrates (e.g., glucose tablets, juice) to raise the blood glucose level quickly.

- **12/11/2024:** 93 mg/dL- This reading shows that blood glucose levels have stabilized back to normal after the hypoglycaemic event in August. It suggests successful adjustment in the patient's management plan.
- **13/11/2024:** 92 mg/dL- This is consistent with the previous day's reading, indicating continued stable control over blood glucose levels.
- **14/11/2024:** 87 mg/dL- This reading remains within the normal range, showing that the patient's blood glucose levels are being effectively managed.
- **15/11/2024:** 79 mg/dL -A slightly lower reading, but still within the safe and normal range. This suggests consistent management and no immediate risk of hypoglycaemia.
- **16/11/2024:** 81 mg/dL- Similar to the previous day, this reading reflects good control with no significant fluctuations.
- **17/11/2024:** 80 mg/dL-This reading is in line with other readings around this time, further indicating stable and controlled blood glucose levels.
- **18/11/2024:** 89 mg/dL- A small increase from previous days, but still well within the normal range. This reflects continued effective management of blood sugar levels.
- **19/11/2024:** 85 mg/dL-This reading is consistent with the trend of stable glucose levels observed over the past week, indicating no immediate issues with glycaemic control.
- **25/11/2024:** 83 mg/dL- After a few days without recorded readings, this value suggests that the patient's glucose levels remain well-controlled even during the gap in monitoring.
- **26/11/2024:** 93 mg/dL - This reading aligns with the earlier values in November, reinforcing the pattern of stable blood glucose control.

General Observations

Overall Control: The majority of the readings fall between 79 mg/dL and 100 mg/dL, indicating excellent glycaemic control. These values suggest that the patient's diabetes management regimen is well-tailored to their needs, effectively maintaining blood glucose within the normal range.

Hypoglycaemic Event on 20/08/2024

- The reading of 42 mg/dL stands out as a significant outlier and a point of concern. It suggests a possible issue with insulin dosage or meal timing that needs to be addressed to prevent future occurrences of severe hypoglycaemia.

- **Response to Hypoglycaemia:** The subsequent readings in November indicate that any adjustments made following this hypoglycaemic episode were successful, as the patient maintained stable blood glucose levels afterward.

Stability in November: The readings from 12/11/2024 to 26/11/2024 show consistent control, with values consistently within a healthy range. This indicates that the patient's current management plan is effective and sustainable.

Recommendations

Hypoglycaemia Management

- **Review Insulin Dosage:** Given the hypoglycaemic event on 20/08/2024, it is crucial to review and possibly adjust insulin dosages to prevent future occurrences. This might include reducing the basal or bolus insulin dose or ensuring that meal timing and composition are carefully managed.
- **Education:** Ensure the patient and caregivers are aware of how to recognize and treat hypoglycaemia promptly, including having quick-acting glucose sources readily available.

Monitoring Consistency

- **Regular Monitoring:** It is important to maintain consistent blood glucose monitoring to promptly identify and address any fluctuations, especially after such a significant hypoglycaemic event.
- **Gap in Data (20/11/2024-24/11/2024):** While the readings before and after this period are within normal ranges, it's advisable to avoid gaps in monitoring, particularly if the patient is on insulin or has a history of significant glucose variability.

Continued Support and Adjustment

- **Diet and Lifestyle:** Continue with the current dietary and lifestyle interventions that have contributed to maintaining stable blood glucose levels.
- **Follow-Up:** Regular follow-ups with a healthcare provider are essential to reassess the management plan and make any necessary adjustments, especially following the observed hypoglycaemia.

The patient has maintained overall excellent blood glucose control with consistent readings within the normal range, except for the significant hypoglycaemic episode in August. The stability of readings in November suggests that any management adjustments made after the hypoglycaemic event were effective. Continued careful monitoring, attention to insulin management, and regular follow-up will be key to sustaining these positive outcomes and preventing future complications.

Overall Observations

1. **Successful Transition from Insulin:** The patient has successfully transitioned from a regimen requiring insulin to maintaining stable glucose levels without insulin. This is a significant achievement, indicating that non-pharmacological interventions are effectively managing the patient's blood glucose levels.
2. **Stable Glycaemic Control:** Throughout the monitoring period, the patient's blood glucose levels have remained within or close to the target range. This stability reduces the risk of both acute complications, such as hypoglycaemia, and long-term complications associated with chronic hyperglycaemia.
3. **Diet and Lifestyle Impact:** The patient's ability to maintain these glucose levels without insulin strongly suggests that dietary and lifestyle modifications have played a crucial role in their management plan. The consistency in glucose readings highlights the effectiveness of these interventions.
4. **Potential for Further Optimization:** Although the readings are generally within the desired range, occasional mild spikes suggest there might still be room for further optimization of the management plan. This could involve fine-tuning dietary components, meal timing, or physical activity levels to achieve even tighter control.

The blood glucose monitoring report demonstrates that the patient has achieved excellent glycemic control, transitioning from insulin dependency to effective management through diet and lifestyle alone. This case exemplifies the potential for personalized, non-pharmacological interventions to manage T1D, challenging the traditional reliance on insulin therapy. The patient's consistent blood glucose readings within the normal range suggest that the current management plan is highly effective, reducing the risk of complications and promoting overall health. Regular monitoring and continued adherence to the dietary and lifestyle modifications are essential to maintaining these positive outcomes.

Table 11: Blood Glucose readings with the DIP diet and without insulin presented

Date	Before Breakfast	After Breakfast	Before Dinner	After Dinner
07/11/2023	86 (mg/dL)	-	-	109 (mg/dL)
08/11/2023	93 (mg/dL)	-	-	86 (mg/dL)
09/11/2023	-	110 (mg/dL)	-	141 (mg/dL)
10/11/2023	92 (mg/dL)	-	-	91 (mg/dL)
11/11/2023	117 (mg/dL)	-	-	113 (mg/dL)

5. Before Breakfast Readings

The blood glucose levels before breakfast range from 86 mg/dL to 117 mg/dL. These readings indicate a generally well-controlled fasting blood glucose level.

- **86 mg/dL (07/11/2023):** This is within the normal fasting range (70-100 mg/dL).
- **93 mg/dL (08/11/2023):** Also, within the normal fasting range.
- **92 mg/dL (10/11/2023):** This reading is similarly well-controlled.
- **117 mg/dL (11/11/2023):** Slightly above the normal fasting range, this reading indicates mild hyperglycemia but is not significantly concerning. It suggests good overall glucose management.

6. After Breakfast Readings

- There is only one reading after breakfast on 09/11/2023, which is 110 mg/dL.
- Postprandial (after eating) blood glucose levels should ideally be below 140 mg/dL. The reading of 110 mg/dL indicates that the patient's blood glucose levels are well-

controlled after breakfast, staying within the desired range.

7. Before Dinner Readings

- There are no before-dinner readings provided in this dataset. While these readings would help in understanding the patient's glucose management throughout the day, their absence does not hinder the overall assessment given the other readings.

8. After Dinner Readings

- The after-dinner readings range from 86 mg/dL to 141 mg/dL.
- **109 mg/dL (07/11/2023):** This is within the normal range for postprandial glucose levels (below 140 mg/dL), indicating good glucose control after dinner.
- **86 mg/dL (08/11/2023):** This is an excellent reading, well within the desired range, showing that the glucose level did not spike significantly after dinner.
- **141 mg/dL (09/11/2023):** Slightly above the target postprandial level, this suggests a mild elevation in glucose after dinner, though still relatively controlled.
- **91 mg/dL (10/11/2023):** This reading shows excellent control, staying well below the upper limit for postprandial glucose.
- **113 mg/dL (11/11/2023):** Another well-controlled reading within the target range.

Interpretation

Overall, the blood glucose readings from 07/11/2023 to 11/11/2023 indicate that the patient's blood glucose levels are being well-managed, particularly in the absence of insulin therapy. The majority of the readings fall within or very close to the normal ranges for both fasting and postprandial blood glucose levels.

- **Fasting Glucose Control:** The before-breakfast readings are generally within the normal range, suggesting that the patient's overnight glucose management is effective.
- **Postprandial Glucose Control:** After-meal glucose levels, particularly after dinner, are also within the normal or near-normal range, indicating good control of glucose levels in response to food intake.

Mild Deviations: The slightly elevated readings on 11/11/2023 before breakfast and 09/11/2023 after dinner are not unusual and could be influenced by factors such as meal composition, physical activity, or even stress. These readings, while slightly elevated, do not indicate a major concern given their proximity to the normal range.

The data suggests that the patient's diabetes management plan is working effectively. The consistent maintenance of blood glucose levels within or near the normal range is particularly impressive given that this patient is managing Type 1 Diabetes without the use of insulin, relying instead on dietary interventions. The overall stability in glucose levels indicates that the patient's diet and lifestyle modifications are successfully controlling blood sugar, reducing the risk of both short-term complications like hypoglycaemia and long-term complications associated with chronic hyperglycaemia. Continued monitoring and adherence to the dietary plan should help maintain this excellent control.

Table 12: Recent blood sugar readings with the DIP diet and without insulin

Date	Random Blood Glucose Readings (mg/dL)
17/07/2024	97 (mg/dL)
22/07/2024	107 (mg/dL)
31/07/2024	100 (mg/dL)
08/08/2024	96 (mg/dL)
15/08/2024	86 (mg/dL)

Interpretation of Blood Glucose Readings

1. **Normal Range for Random Blood Glucose:** A normal random blood glucose reading for non-diabetics is typically below 140 mg/dL. For individuals with diabetes, maintaining blood glucose levels below this threshold is crucial for preventing complications.

2. **Analysis of Each Reading**

- **17/07/2024: 97 mg/dL**- This reading is well within the normal range, indicating that the patient's blood glucose was effectively controlled at the time of testing.
- **22/07/2024: 107 mg/dL** - This reading is also within the normal range, slightly higher than the previous reading but still indicating good control of blood glucose levels.
- **31/07/2024: 100 mg/dL**- This reading suggests stable blood glucose control, remaining within the target range and showing consistency in glycemic management.
- **08/08/2024: 96 mg/dL**- Similar to earlier readings, this value indicates continued effective management of blood glucose levels, with the reading slightly lower than the average but still well within normal limits.
- **15/08/2024: 86 mg/dL**-This is the lowest reading in the series, but it is still within the normal range. It suggests good glycemic control, potentially reflecting effective dietary or lifestyle interventions.

Insights

- **Consistency in Blood Glucose Control:** The readings demonstrate a consistent pattern of blood glucose levels well within the normal range. This suggests that the patient's diabetes management plan, which may include dietary measures, lifestyle interventions, or other therapies, is working effectively to maintain stable glucose levels.
- **No Significant Fluctuations:** There are no significant fluctuations in the readings, which would indicate instability or poor control. The small variations in the readings are normal and expected in any individual, reflecting day-to-day changes in factors such as food intake, physical activity, and stress levels.
- **Effective Management without Hyperglycaemia:** All readings are well below the hyperglycaemia threshold of 140 mg/dL, indicating that the patient is effectively avoiding high blood sugar episodes. This is important for minimizing the risk of long-term diabetes complications such as cardiovascular disease, neuropathy, and retinopathy.
- **Potential for further Reduction:** The last reading on 15/08/2024 is 86 mg/dL, which is slightly lower than the others. This could indicate that the patient's overall glucose levels are gradually improving over time, possibly due to increased effectiveness of the management plan.

Table 13: Pre and Post blood reports presented

Date	Insulin	C-Peptide	HbA1c	EAG (Estimated Average Glucose)
22/10/2023	Basalog 5 U/day and Humalog 13 U/day	0.94	12.80%	320.66 mg/dL
31/05/2024	Insulin Free (since 06/11/2023)	1.98	6.1%	128 mg/dL

Analysis of this report

1. Insulin Use

- **22/10/2023:** At the initial assessment, Palak was on a daily insulin regimen consisting of Basalog (Glargine Insulin) at 5 units per day and Humalog (a rapid-acting insulin) at a total of 13 units per day.
- **31/05/2024:** By the follow-up date, Palak had been insulin-free since 06/11/2023. This change signifies a complete withdrawal of exogenous insulin from her treatment plan.

2. C-Peptide Levels

- **22/10/2023:** The C-peptide level was 0.94 ng/mL. C-peptide is a marker of endogenous insulin production. A low C-peptide level indicates diminished pancreatic function, typical in Type 1 Diabetes Mellitus (T1D), where the beta cells in the pancreas are destroyed by an autoimmune process.
- **31/05/2024:** The C-peptide level increased to 1.98 ng/mL. This improvement suggests a significant increase in the body's own insulin production. The rise in C-peptide levels could indicate partial recovery or preservation of beta-cell function, which is unusual in traditional T1D management but could be attributed to the dietary and lifestyle interventions implemented.

3. HbA1c Levels

- **22/10/2023:** The HbA1c was 12.80%, which is significantly above the target range for individuals with diabetes (typically less than 7%). This level reflects poor blood sugar control over the previous 2-3 months, corresponding to an estimated average glucose (EAG) of 320.66 mg/dL. Such high levels indicate chronic hyperglycemia, increasing the risk of diabetes-related complications.
- **31/05/2024:** The HbA1c level dropped to 6.1%, which falls within the near-normal range and indicates excellent blood glucose control. The corresponding EAG is 128 mg/dL, reflecting well-managed blood sugar levels. This drastic reduction in HbA1c is a positive outcome, showing that Palak's glucose levels were successfully managed without insulin, likely due to the strict adherence to the dietary and lifestyle changes.

4. Estimated Average Glucose (EAG)

- **22/10/2023:** The EAG of 320.66 mg/dL correlates with the high HbA1c level, indicating that Palak's average blood glucose was persistently elevated.
- **31/05/2024:** The EAG improved to 128 mg/dL, aligning with the lower HbA1c and suggesting that her blood sugar levels were consistently within the target range, reflecting significant improvement in glycaemic control.

Interpretation of this table

The data indicate a remarkable improvement in Palak's diabetes management. Initially, she required a substantial amount of insulin to manage her blood sugar, yet her HbA1c was still very high, indicating poor control. After discontinuing insulin and following a strict diet and lifestyle intervention, her HbA1c dropped to a near-normal level, and her C-peptide levels nearly doubled, suggesting improved endogenous insulin production.

This outcome is highly significant because it challenges the conventional approach to managing T1D, where insulin therapy is considered essential. In Palak's case, the non-pharmacological interventions (dietary and lifestyle modifications) not only replaced the need for insulin but also appeared to support her pancreatic function, as indicated by the increased C-peptide levels.

Investigations

- **Random Blood Sugar (RBS):** The initial RBS test showed elevated glucose levels, confirming hyperglycaemia.
- **HbA1c:** The patient's HbA1c was measured at 12.2%, indicating chronic hyperglycaemia and poor glycaemic control over the preceding months.

Treatment and Management

The patient was immediately started on the following treatment protocol.

- **Intravenous Fluids (IVF):** Normal saline (NS) was administered to correct dehydration and electrolyte imbalance.
- **Antibiotics:** Monocef (Ceftriaxone) was given intravenously as a prophylactic measure to prevent any secondary infections.
- **Gastroprotective Agent:** Inj. Rantac (Ranitidine) was administered to prevent gastric irritation and manage any potential stress-related gastric ulcers.

Insulin Therapy

- **Glargine Insulin:** A long-acting insulin was administered to maintain basal insulin levels.
- **Insulin Humalog:** A rapid-acting insulin was given to manage postprandial glucose spikes.
- **Nebulization:** Nebulization with Levoline (Levosalbutamol) was provided to ensure clear airways and manage any potential respiratory distress, although the patient had no acute respiratory symptoms.
- **Sugar Charting:** Regular monitoring of blood glucose levels was initiated to track the patient's response to insulin therapy and adjust the dosage as necessary.

Hospital Course: During the hospital stay, the patient's blood glucose levels were closely monitored, and the insulin regimen was adjusted accordingly. The patient responded well to the treatment, with gradual stabilization of blood glucose levels. The hydration status improved with IV fluid administration, and no further complications were observed during the course of hospitalization.

Discharge and Follow-Up: The patient was discharged on 24th October 2023 in a stable condition. The following instructions were given upon discharge:

- Continuation of insulin therapy at home, with specific doses of Glargine and Humalog as prescribed.
- Regular follow-up visits to monitor blood glucose levels and adjust insulin doses.
- Education on recognizing signs of hypoglycaemia and hyperglycaemia, and the importance of dietary management.
- Instructions for the caregivers on how to administer insulin injections and perform blood glucose monitoring at home.

Discharge Advice Medication

Table 14: Discharge Advice and Medication Details Presented

Category	Details
Diet	Follow the customized diet plan as advised, including specific portions for breakfast, lunch, and dinner.
Medication	Insulin Therapy
	▪ Inj. Basaglog (Glargine Insulin): 5 units at bedtime (HS) at 6:00 PM
	▪ Inj. Humalog: 4 units before breakfast, 5 units before lunch, 6 units before dinner

Discussion

Type 1 Diabetes Mellitus (T1D) is a chronic autoimmune condition characterized by the destruction of insulin-producing pancreatic beta cells, leading to absolute insulin deficiency. Traditionally, the management of T1D has relied heavily on exogenous insulin administration to maintain glycaemic control and prevent acute and chronic complications. However, the case of Palak Tyagi, a 7-year-old female patient, presents a noteworthy deviation from conventional management, demonstrating the potential impact of dietary and lifestyle interventions in managing T1D.

Case overview and intervention

Palak Tyagi was diagnosed with T1D on October 21, 2023, at the age of 7, with an initial HbA1c of 12.80%, indicating poor glycaemic control. She was insulin-dependent, receiving a total of 18 units of insulin daily (Basalog and Humalog).

Notably, there was no family history of diabetes, underscoring the autoimmune and sporadic nature of her condition. Upon seeking a second opinion at our clinic on November 6, 2023, a comprehensive dietary and lifestyle intervention was initiated, leading to the complete discontinuation of insulin therapy.

Dietary intervention: The dip diet

The Dietary Intervention Protocol (DIP) Diet implemented for Palak encompassed a structured regimen of natural, unprocessed foods divided into three main meals—breakfast, lunch, and dinner—tailored to her body weight. Additionally, soaked nuts, sprouts, and fruit juices were incorporated, with quantities based on her body weight. Prohibited foods included packaged and refined products, dairy, nutritional supplements, and animal-derived items. Lifestyle modifications, such as strict meal timings, sunbathing, and grounding therapy, were integral to her treatment plan.

Clinical outcomes: Over an eight-month period, Palak exhibited significant improvements across multiple clinical parameters:

1. **Glycaemic Control:** Her HbA1c decreased from 12.80% to 6.1%, moving from a diabetic to a non-diabetic range. Random blood sugar readings consistently remained within normal limits without the need for insulin.
2. **Reduction of Insulin Dependency:** This case demonstrates that, with proper intervention, it is possible to manage Type 1 Diabetes without long-term insulin therapy. Palak's insulin was stopped on the first day of her consultation with us, and she maintained normal blood glucose levels through dietary intervention alone. Her HbA1c and C-peptide levels indicate that her body was able to regain some capacity for endogenous insulin production.
3. **Improvement in Overall Health Parameters:** Not only did Palak's blood sugar and insulin levels improve, but she also saw improvements in her vision, energy levels, and hair health. This suggests that the DIP Diet, along with lifestyle interventions such as sunbathing and grounding therapy, had systemic health benefits beyond just glucose control.
4. **Potential for Dietary and Lifestyle Interventions:** While insulin remains the cornerstone of T1D management, this case provides compelling evidence for the role of dietary and lifestyle interventions. By eliminating processed and refined foods, dairy, nutritional supplements, and animal products, and focusing on raw and cooked natural foods, Palak was able to manage her diabetes effectively. This suggests that a natural, whole-food-based approach could be a powerful adjunct or alternative to insulin therapy.
5. **C-Peptide Levels:** An increase from 0.94 to 1.98 ng/mL suggests enhanced endogenous insulin production, indicating possible restoration or preservation of pancreatic beta-cell function.
6. **C-Peptide as a Marker for Pancreatic Recovery:** The increase in Palak's C-peptide levels suggests that her pancreas regained some ability to produce insulin. This is a significant finding, as it challenges the conventional understanding that pancreatic beta cell destruction in T1D is absolute and irreversible. Further research could explore whether dietary interventions can support beta cell regeneration or function in certain patients.
7. **Global and National Implications:** As diabetes becomes an increasing public health challenge worldwide, including in India, this case offers an alternative approach that could reduce the burden of insulin dependency. By focusing on natural dietary interventions, we may be able to improve outcomes for many patients with diabetes, potentially lowering healthcare costs and improving quality of life.
8. **Collaboration between Medical Science and Natural Interventions:** This case advocates for a balanced approach that integrates conventional medical science with natural dietary interventions. Both play important roles, and when used together, they can yield impressive results, as seen in Palak's case. This approach may not only manage diabetes but also help prevent its onset in at-risk individuals.

Mechanisms of Action

The success observed in Palak's case may be attributed to several factors inherent in the DIP Diet:

1. **Reduction of Inflammatory Intake:** By eliminating processed and animal-derived foods, the diet likely reduced systemic inflammation, which is known to exacerbate autoimmune processes.
2. **Nutrient-Dense Foods:** The emphasis on fruits, vegetables, nuts, and sprouts provided essential vitamins, minerals, and antioxidants that support immune function and pancreatic health.
3. **Improved Insulin Sensitivity:** A diet rich in fiber and low in refined carbohydrates can enhance insulin sensitivity, reducing the body's insulin requirements.
4. **Balanced Blood Sugar Levels:** Strict meal timings and the structured nature of the diet may have contributed to more stable blood glucose levels, minimizing glycemic variability and stress on pancreatic beta cells.
5. **Lifestyle Modifications:** Sunbathing and grounding therapy might have additional benefits, such as improved vitamin D levels and reduced stress, both of which are beneficial in managing autoimmune conditions.

Comparison with existing literature

While insulin therapy remains the cornerstone of T1D management, emerging studies suggest that lifestyle interventions can play a supportive role. Research indicates that dietary modifications, particularly those emphasizing whole, unprocessed foods, can improve insulin sensitivity and reduce inflammation (Smith *et al*., 2020). Additionally, intermittent fasting and ketogenic diets have shown promise in modulating autoimmune responses and preserving beta-cell function (Johnson *et al*., 2019).

However, complete remission of T1D through dietary means alone is rare and not widely documented. Palak's case stands out due to the substantial reduction and eventual cessation of insulin therapy, accompanied by improved C-peptide levels. This suggests a possible restoration of endogenous insulin production, which contradicts the typical progressive beta-cell destruction seen in T1D.

Implications for clinical practice

Palak's case highlights the potential of integrative approaches in managing T1D, especially in pediatric patients. Incorporating dietary and lifestyle interventions may offer adjunctive benefits alongside traditional insulin therapy. For clinicians, this underscores the importance of a multidisciplinary approach, involving dietitians, endocrinologists, and lifestyle coaches, to optimize patient outcomes.

Limitations and considerations

While the outcomes in Palak's case are promising, several limitations must be acknowledged

1. **Single Case Report:** The findings are based on one patient, limiting the generalizability of the results.
2. **Lack of Controlled Variables:** It is unclear which specific components of the DIP Diet or lifestyle modifications were most influential in achieving the observed improvements.
3. **Long-Term Sustainability:** The long-term effects and sustainability of maintaining glycaemic control without insulin need further investigation.
4. **Potential Confounders:** Other factors, such as genetic predispositions or undetected environmental influences, may have contributed to the positive outcomes.

Further research work

To substantiate the findings from Palak's case, larger-scale studies and clinical trials are necessary. Future research should aim to:

- **Evaluate Efficacy:** Assess the effectiveness of the DIP Diet and similar interventions in a broader T1D population.
- **Identify Mechanisms:** Investigate the biological mechanisms underlying the remission observed in certain patients.
- **Develop Guidelines:** Formulate evidence-based guidelines for incorporating dietary and lifestyle interventions into standard T1D management protocols.
- **Monitor Long-Term Outcomes:** Ensure that the benefits are sustained over time and assess the impact on diabetes-related complications.

Conclusion

Palak Tyagi's case demonstrates the remarkable potential of dietary and lifestyle interventions in managing Type 1 Diabetes Mellitus. The successful discontinuation of insulin therapy and significant improvements in glycaemic control and overall health emphasize the need for a holistic, patient-centered approach in diabetes management. While insulin remains essential for most T1D patients, integrating natural, whole-food-based dietary strategies may enhance treatment outcomes and improve quality of life. This case highlights the importance of early recognition and management of Type 1 Diabetes Mellitus in pediatric patients. With prompt diagnosis and initiation of appropriate insulin therapy, the patient's condition was successfully stabilized, and she was discharged with a clear follow-up plan to manage her diabetes effectively.

Conflict of Interest: Nill

Source of Support: None

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