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*Case Report*

# Effectiveness of gum arabica and inulin incorporated formula in the management of type 3c diabetes mellitus: A case study

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## ABSTRACT

Diabetes stands as a major stumbling block worldwide. The rising incidence of type 3c diabetes mellitus (T3c DM) remains largely underrecognized due to diagnostic challenges and its frequent misclassification as type 2 diabetes. T3c DM accounts for approximately 5–10% of all diabetic cases, linked to exocrine pancreatic dysfunction, underscores the need for effective management strategies. Erratic blood sugar levels, unexplained weight loss, persistent fatigue, and increased susceptibility to infections are the symptoms, though often subtle, that are indicative of the unique pathophysiology of T3c DM. Here, we report a case of T3c DM in a 29-year-old male who came with the complaints of persistent hyperglycemia. Following a defined duration of gum arabica and inulin-incorporated formula to the patient showed a notable reduction in fasting blood glucose levels. This outcome signifies the effectiveness of the gum arabica and inulin incorporated formula in facilitating the patient's health and underscores its potential significance in managing high blood sugar levels.

**Keywords:** Blood sugar management, Early recovery, Good health and wellbeing, Healthcare, Pancreatogenic diabetes

## INTRODUCTION

A specific type of secondary diabetes linked to exocrine pancreatitis is called pancreatogenic diabetes. Chronic pancreatitis is the most frequent exocrine pancreas illness linked to the onset of diabetes. The development of type 3c diabetes mellitus (T3c DM) may occur from insufficient pancreatic production of the hormone insulin.[1] Pathological conditions that impair or destabilize the functional capacity of the pancreas may serve as a significant precipitating factor in the development of pancreatogenic diabetes. Surgical manipulation of the pancreas, including partial or total removal, may also precipitate T3c DM. The mechanism behind the insulin's action has been depicted in Figure 1. When the body does not produce enough insulin, blood glucose levels start to climb above normal, which can cause problems if not addressed.[2] Pain in the abdomen, more than usual fatigue, too much flatulence, greasy or fatty stools, polydipsia, polyuria, genital itchiness or thrush, blurry eyesight are certain signs and symptoms of T3c DM. The cause for the occurrence of T3c DM is multifactorial; however, hemochromatosis, cystic fibrosis, pancreatic ductal adenocarcinoma, chronic pancreatitis, and prior pancreatic surgery.[3] The pathophysiology of the Type 3cDM is represented in the Figure 1.[4]

## CASE REPORT

This case presents the complex clinical picture of a 29-year-old young adult who initially appeared asymptomatic till about a year ago and sought consultation at the outpatient department. He thereafter displayed symptoms such as increased thirst, thrush in his genitals with accompanying itching, and hazy eyesight. The patient reported subtle stomach pain with a prickling sensation that began 3 weeks ago and was treated with medicine. Notable weight loss of 12.9% during the previous 5 months was also noted, along with an increase in hunger. Meanwhile, the patient stated that the dysuria had persisted for the previous 3 weeks.

### Clinical history

A clinical examination showed that there was no vomiting, headache, or fever. Two years ago, there was a significant occurrence of chronic pancreatitis in the patient's medical history. Notably, the patient's prior history of notable surgical operations is lacking. The patient's social habits,

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including alcohol and tobacco use, as well as drug use, were carefully examined but were noticeably lacking, ruling out any confounding variables. The patient's symptoms were becoming worse over time, so the doctor decided to admit the patient to the inpatient ward. The main goal of the admission was to perform a thorough diagnostic assessment to determine the underlying disease. A complete investigation needs this calculated disclosure to provide a careful evaluation to determine the final diagnosis and to enable a thorough analysis of the clinical specifics.

**Subjective data**

After carefully examining the subjective data, the complexity of the clinical manifestation was ruled out. The subjective evaluation reveals a range of symptoms in the patient, including constipation, polyphagia, polydipsia, polyuria, and dysuria. In addition, the patient's sleep habits showed that his sleep–wake cycle was improper.

**Anthropometry**

With regards to the objective data, the patient had previously been categorized as overweight; however, at the time of admission, the body mass index was within the normal range, likely reflecting a noticeable weight loss, according to the anthropometry examination, and the measurement of upper arm circumference shows that there is enough subcutaneous fat and somatic protein stores.

**Biochemical data**

Decreased hemoglobin, mean corpuscular volume, and mean corpuscular hemoglobin show clear signs of nutritional anemia, according to the biochemical parameter analysis of the patient. Meanwhile, increased levels of C-reactive protein also highlight the inflammatory aspect linked to anemia. Notably, the hepatic and renal parameters show values that fall within the normal range, giving confidence about the liver and kidney function of the patient. After relevant diagnostic approaches were applied, hyperglycemia with respect to T3c DM was diagnosed. The patient's fasting capillary blood glucose level was 424 mg/dL at admission. Following that, the medical intervention consisted of starting 25 units of short-acting insulin before each of the three main meals.

**Clinical assessment**

Pallor was found during the clinical assessment; however, there was a lack of other critical characteristics such as icterus, clubbing, cyanosis, lymphadenopathy, and edema.

**Diet history**

It was noted that the patient was following a plant-based diet (vegan lifestyle) by avoiding meat, eggs, milk, and milk products. Furthermore, the patient occasionally consumes fruits, and adherence to other dietary groups is maintained. The information on food patterns adds a great deal to our understanding of the patients' complex lifestyles and health dynamics.

**Intervention**

As per the protocol, nutrition care process was carried out using the highly dependable nutritional screening tool nutritional risk screening 2002, which consists of a seven-step questionnaire, to assess the nutritional status of the patient on the 1$^{st}$ day of admission. This instrument is ideal for accurately determining whether malnutrition or nutritional risk is present.[5] A thorough nutritional assessment was then conducted in compliance with the European Society for Clinical Nutrition and Metabolism criteria,[6] which consisted of developing a diet plan that included 1890 calories and 63 g of protein (13% of total calories) With 260 g of carbohydrates (60% of total calories), 44 g of fat (21% of total calories). In addition, an insulin carbohydrate counting method was employed to prevent post-meal spikes or drops in blood glucose. A South Indian menu based on exchange lists and the concepts of carbohydrate counting was also developed. This comprehensive care plan highlights a holistic approach to patient management by reflecting a synergistic blend of medical and dietary skills. The precise blending of nutritional advice that emphasizes carbohydrates with insulin therapy is a nuanced strategy meant to maximize patient outcomes. A thorough and effective 24-h dietary recall was carried out, using standardized measuring cups and spoons every day. The implementation of standardized measurement instruments is indicative of a dedication to methodological excellence, strengthening the general fineness and reliability of the dietary data acquired by this comprehensive recall procedure.

**Follow-up**

Following a few days, even with the strict diet surveillance in place, the patient became hesitant to follow the counseled meal pattern due to increased anxiety about his consistently high blood sugar levels. The patient's attendant persistently claimed that the rise in blood glucose was solely attributed to food intake. Despite numerous instances of nutritional counseling, it made it difficult for the patient to follow his diet. Frequent reviews revealed a troubling trend: by the 4$^{th}$ day of hospitalization, the patient's nutritional intake had decreased to <10% in terms of both protein and calorie components. This observed deterioration highlights the urgent need for focused therapies meant to address psychological obstacles preventing the patient from receiving the best nutritional assistance during their illness, as well as the physiological aspects of managing their diabetes.

These insights add to an in-depth understanding of the complex issues surrounding diabetes care. After much discussion with a multidisciplinary team, we suggested a diabetic-friendly formula. The main source of fiber in this formulation is gum Arabica and inulin, which have been

shown to have increased anti-hyperglycemic activity.[7,8] Inulin, classified as a water-soluble storage polysaccharide and non-digestible carbohydrate, is a member of the fructan group. Its use as a dietary supplement has expanded in recent years, owing to evidence suggesting beneficial impacts on blood glucose regulation.[9] By delaying gastric emptying, inulin slows the rate of glucose absorption in the small intestine, thereby attenuating postprandial blood glucose spikes. In addition, as a fermentable prebiotic fiber, inulin is metabolized by gut microbiota into short-chain fatty acids (SCFAs), such as acetate, propionate, and butyrate.[10] These SCFAs play a crucial role in enhancing insulin sensitivity and suppressing hepatic gluconeogenesis, contributing to improved glucose homeostasis. Evidence from clinical studies indicates that supplementation with inulin or inulin-type fructans may lead to moderate yet meaningful reductions in fasting plasma glucose, glycated hemoglobin, serum insulin concentrations, and the homeostatic model assessment of insulin resistance, particularly in individuals with prediabetes or type 2 diabetes.[11] Gum Arabica, also referred to as Acacia gum, is a water-soluble dietary fiber derived from the hardened exudates of *Acacia senegal* and *Acacia seyal* trees. It is widely recognized for its potential blood glucose-lowering (hypoglycemic) effects.[12,13] Gum Arabic forms a viscous gel in the gut, slowing gastric emptying and glucose absorption, which helps reduce postprandial blood sugar spikes. In the colon, it is fermented into SCFAs that enhance insulin sensitivity, inhibit hepatic glucose production, and reduce inflammation. It also increases adiponectin levels and decreases pro-inflammatory markers such as tumor necrosis factor-alpha, further supporting glucose regulation.[14] After thorough evaluation, it was recommended to incorporate a scientifically formulated combination of gum Arabica and inulin-based one into the regimen. This blend leverages the complementary benefits of both soluble fibers, aiming to optimize metabolic health by enhancing glycemic control, improving insulin sensitivity, and promoting a balanced gut microbiota. Inulin-type fructans are typically considered safe when consumed at levels up to approximately 20 g/day.[15] Meanwhile, gum Arabica holds a generally recognized as safe status, with no formally established upper intake limit; however, intake exceeding 30 g/day[16] may lead to mild gastrointestinal discomfort in some individuals. The formulation contains a precise blend of 6 g of gum Arabica and 10 g of inulin/100 g of the product. Multiple studies suggest that a daily intake of around 10 g of these fibers over a period of 4 weeks[11,14] is ideal for achieving their beneficial effects on blood glucose regulation. The formula was suggested to be taken orally twice a day, with three scoops reconstituted in 100 mL of water. After a prolonged period, the patient, who had initially been resistant, began formula intake following structured counseling. Notably, on nutrition support day 5, the patient's capillary blood glucose levels had significantly decreased to below 100 mg/dL, and the number of units of insulin that were given had also significantly decreased to 10 units/day. The patient adhered to the formula for 30 days, during which their blood glucose levels remained well regulated, neither excessively elevated nor reduced, in conjunction with a balanced and controlled diet. This period of dietary intervention led to the stabilization of glycemic control. Notably, following this 30-day regimen, the patient was able to discontinue insulin therapy entirely with no significant fluctuations in blood sugar levels observed. This outcome suggested the potential of the gum Arabica and inulin incorporated diabetic friendly formula, in combination with proper nutritional support, to effectively manage blood glucose levels and reduce reliance on exogenous insulin in the individuals with T3c DM.

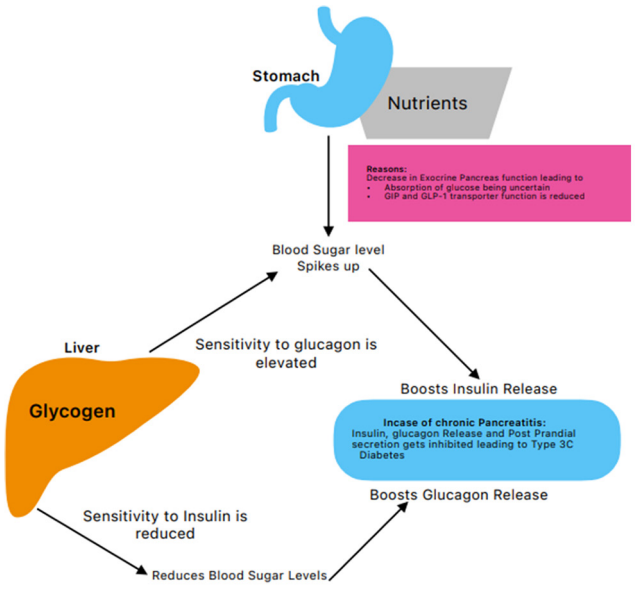


**Figure 1:** Pathophysiology of Type 3C Diabetes Mellitus

### Challenges encountered

1. Persuading the multidisciplinary team to initiate the scientific formula
2. Convincing family members of the need for the specialized formula
3. Cost and availability of the formula.

## DISCUSSION

On observing the gradual reduction in the patient's blood sugar levels, we dedicatedly focused on establishing an optimal carbohydrate insulin ratio to prevent the occurrence of hypoglycemia. The patient underwent comprehensive counseling, specifically emphasizing the consumption of whole grains, green leafy vegetables, and legumes, supplemented with a meticulously calculated scientific formula. As a result of this tailored approach, the patient's blood glucose levels were

successfully regulated, which led to the eventual discharge. This observation underscores the promising impact of the efficacy of the gum Arabica and inulin combined formula in the management of diabetes, marking a noteworthy improvement in their medical condition.

## CONCLUSION

The formula incorporating gum Arabica and inulin has shown positive results in maintaining the patient's elevated blood glucose levels, highlighting its potential as a therapeutic intervention for managing glycemic control. Through adherence to carbohydrate counting, insulin carbohydrate ratio adjustments, and comprehensive counseling strategies, combined with the gum Arabica and inulin-based formula, blood sugar levels can be maintained in range. This approach not only suggests a promising alternative to traditional management strategies but also emphasizes the importance of a holistic, multifaceted treatment plan in achieving effective blood glucose regulation.

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