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Effect of Sun-dried Tomato Powder as an add on therapy on Glycemic Profile, Renal Function and Liver Function in an individual with type 2 diabetes mellitus (T2DM): A Case Report

Altaf Ahmed [1*], Prashanth Shetty [2], Geetha B Shetty, [3] Moodala Girishankara [4]

[1,2,3] Department of Diet and Nutrition, S.D.M College of Naturopathy and Yogic Sciences, Ujire, Karnataka, India.
[4] Department of Yoga therapeutics, S.D.M College of Naturopathy and Yogic Sciences, Ujire, Karnataka, India.

ABSTRACT:
Type 2 Diabetes mellitus (T2DM) is common metabolic disease, which is characterized by the presence of hyperglycemia. A 38-year-old male patient presented with hyperglycemia and a history of K/C/O type 2 diabetes mellitus (T2DM) dating back four years. It was recommended that he take the anti-diabetic medication, Metformin 500mg tablets, twice daily after meals to help manage his blood sugar levels. Even after using anti-diabetic medications, the patient's blood sugar levels remained uncontrolled. The patient visited the SDM Naturopathy OPD in Dharwad ,Karnataka for further management. After taking a detailed case history, he was advised to consume 15 grams of sun-dried tomato powder every morning, mixed in 150 ml of water on an empty stomach, for a period of 60 days, alongside his regular medication. The study showed improvements in Fasting Blood Sugar (134–111 mg/dl), Post-prandial Blood Sugar (171–148 mg/dl), and HbA1c (7.1–6.9%). The baseline renal and liver profiles were normal and monitored at five time points throughout the study. Both renal and liver functions remained within normal limits during the entire study period. This case report suggests that sun-dried tomato powder may help improve glycemic control while maintaining renal and liver function in patients with T2DM. However, a larger, more robust randomized controlled trial is needed to confirm the efficacy of sun-dried tomato powder as a safe and affordable intervention in clinical practice.

KEYWORDS: Glycemic profile, Liver function, Renal function, Sundried tomato powder, Type 2 Diabetes mellitus.

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***Corresponding Author:**
Dr Altaf Ahmed
PG Scholar,
Department of Diet and Nutrition
SDM College Of Naturopathy and Yogic Sciences, Ujire, Karnataka, India
Email: draltafahmed06@gmail.com

INTRODUCTION:

Type 2 Diabetes mellitus (T2DM) is a common metabolic disease, which is characterized by the presence of hyperglycemia due to impairment of insulin secretion, defective insulin action or both. [1-2] . The chronic hyperglycemia leads to significant long term micro and macro vascular Complications. [3] According to the International Diabetes Federation, the prevalence of Diabetes would rise from 10.5% in 2021 to 11.3% by 2030 and 12.2% by 2040. [4] and the global prevalence of T2DM estimated reach around 642 million by 2040. [5].An association has been observed between T2DM and abnormal renal and liver function indices.[6-7]The two most common treatment modalities for type 2 diabetes are insulin and oral anti-diabetics, both of which have side effects. The main ones are drug-induced hypoglycemia, weight gain, and nutritional deficiencies. [8]

Tomatoes are rich in potent antioxidants, including lycopene, saponins, ascorbic acid, carotene, flavonoids (such as kaempferol), tocopherol, folic acid, and other bioactive compounds. They also provide essential minerals like potassium and magnesium. Additionally, tomatoes have a low glycemic index, making them a unique food that can benefit individuals with diabetes.[9-10].Lycopene, a powerful antioxidant found in tomatoes, helps increase the concentration of adiponectin, which is a specific adipokine, having an effect on insulin sensitization and also reduces oxidative stress and there by reduces inflammatory cytokines. [11-13]. Saponins of tomato extract (STE) ameliorate the symptoms of oxidative stress, lipid metabolism disorders, visceral fat deposition and fatty liver disease. [14]. Lycopene also helps in the decrease in Bcl-2-associated X protein and prevent Cisplatin-induced nephrotoxicity. [15]. Lycopene helps in ameliorate crystal deposition, reduced oxidative stress, decrease inflammation and prevent kidney injury, hence restores renal function. [16] The bioavailability of Lycopene is more in sun-dried tomatoes as compared to fresh ones. [17]Hence we attempted to see the effect of sun-dried tomato powder as an adjunctive therapy on glycemic, renal and liver profile in type 2 diabetes patient.

Patient information:

A 38-year-old male patient came to SDM Yoga and Naturopathy OPD in Dharwad Karnataka, which is located in South India on 22 of March 2023. The patient's primary concern was hyperglycemia. He has been a known case of type 2 diabetes mellitus for the past four years. He was prescribed the anti-diabetic medication Tab Metformin 500 mg to be taken twice daily after meals. However, despite adhering to the medication, his blood sugar levels remain uncontrolled. The patient is a teacher by profession, a nonsmoker, and has no family history of type 2 diabetes or obesity.

Clinical findings:

Upon the patient's arrival at the SDM Yoga and Naturopathy OPD in Dharwad Karnataka on March 22, 2023, a comprehensive medical history was taken. The patient had a BMI of 25.6 kg/m². Resting blood pressure was recorded at 132/84 mmHg, with a pulse rate of 82 bpm. Laboratory results revealed fasting blood sugar of 134 mg/dL, postprandial blood sugar of 171 mg/dL, and an HbA1c level of 7.1%. Both renal and liver profiles were within normal limits. During the physical examination, acanthosis nigricans was observed on the posterior aspect of the patient's neck.

Diagnostic assessment:

1. GYCEMIC PROFILE – Fasting Blood Sugar (FBS), Post Prondial Blood Sugar (PPBS), Glycated Haemoglobin (HbA1c) was recorded on base line and 60th day.
2. RENAL PROFILE- Blood Urea, Serun Creatinine and Serum Electrolytes were recorded on Baseline, 15th, 30th, 45th, and 60th day
3. LIVER PROFILE- AST, ALT, Total Bilirubin, Direct Bilirubin and Indirect Bilirubin were recorded on Baseline, 15th, 30th, 45th, and 60th day.

THERAPEUTIC INTERVENTION:

Sun- dried tomato supplementation

Ripe Roma Tomatoes harvested 70 days post-planting were utilized to make powder. Sun-dried tomatoes were made by exposing sliced tomatoes to 8 hours of direct sunlight daily for 10 days. The precise amount of powder, 15 grams, was measured with a weighing machine. The

powder that was measured was mixed with 150 ml of lukewarm water, thoroughly combined, and administered in the early morning on an empty stomach for 60 days as an intervention along with Anti diabetic medicine. Prior to the intervention, the patient was advised to adhere to a normal diet and lifestyle, which he did before consuming sun-dried tomato powder.

Outcome Measures:

At the end of the 60th day, a reduction in the glycemic profile was observed. There were no significant changes in the renal and liver profiles. The details of the laboratory investigations are presented in Table 1. Figures 2, 3, and 4 illustrate the changes in the glycemic, renal, and liver profiles, respectively. The patient was monitored by the treating doctor during the follow-up period, with follow-ups conducted via telephone calls at 15-day intervals to track the prognosis. No adverse events were reported during this period.

Follow-up:

Patient came for regular follow up visit for monitoring the dose and assessment which was scheduled on 15th day, 30th day, 45th day and 60th day. On every visit, asked about his complaints and were recorded. Complaints were recorded in patients own words. The timeline of the study presented in Fig. 1. No other interventions are given other than Sun-dried Tomato Powder. As per recent follow up his blood sugar levels were maintained well and patient was happy with the improvement.

Table- 1: Changes in the Glycemic, Renal and Liver profiles:

Parameters	Baseline	15th day	30th day	45th day	60th day
Glycemic profile:					
FBS (mg/dl)	134	-	-	-	111
PPBS (mg/dl)	171	-	-	-	148
HbA1c (%)	7.1	-	-	-	6.9
Renal Profile:					
Urea (mg/dl)	26.4	26.3	27	26.9	27.6
Creatinine (mg/dl)	0.9	0.9	0.8	0.9	0.9
Na (m mol/l)	142	143	141	144	144
K (m mol/l)	4.9	4.9	5.0	4.8	5.0

Cl (m mol/l)	100.4	101.1	101.2	100.3	101.3
Liver Profile:					
AST (U/L)	35	37	38	37	36
ALT (U/L)	43	41	44	42	45
Total B. (mg/dl)	1.0	1.0	1.1	1.0	1.0
Bilirubin Direct (mg/dl)	0.2	0.1	0.3	0.2	0.2
Bilirubin Indirect (mg/dl)	0.80	0.90	0.80	0.80	0.80

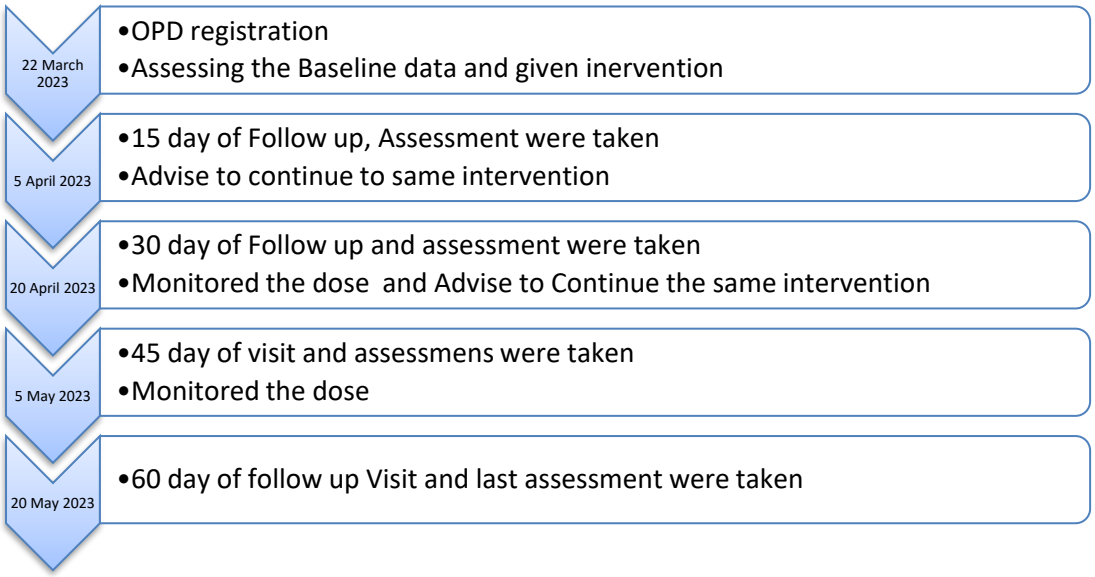

Figure-1: Timeline about the treatment and follow up

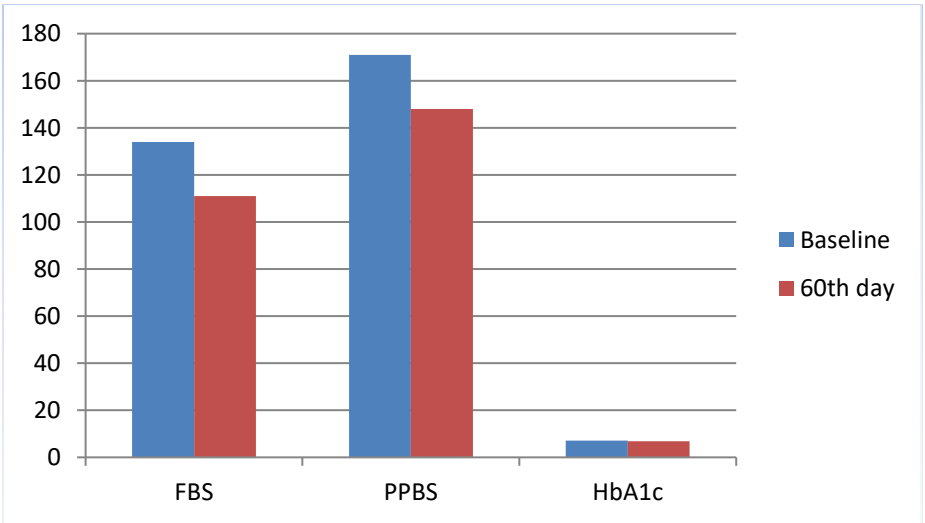

Figure- 2: Changes in Glycemic Profile

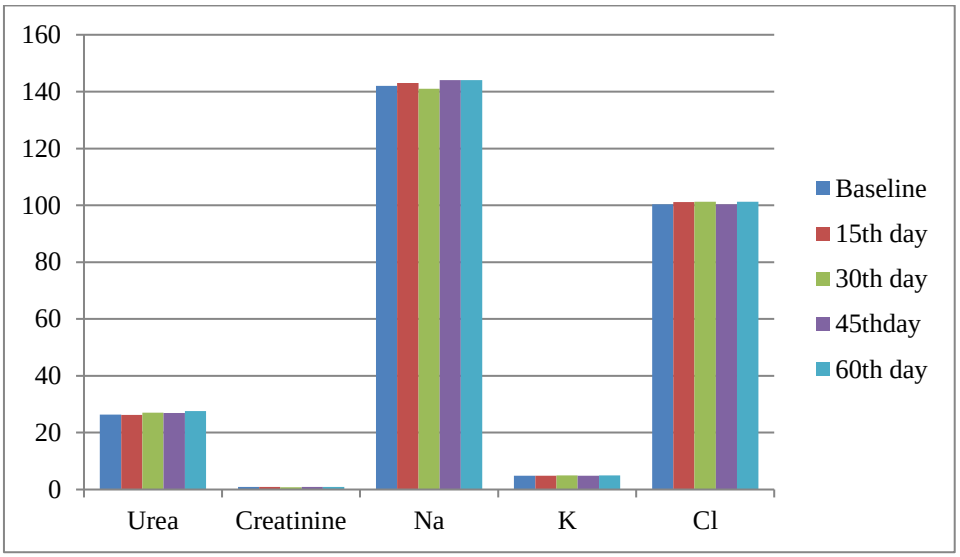

Figure- 3: Changes in Renal Profile

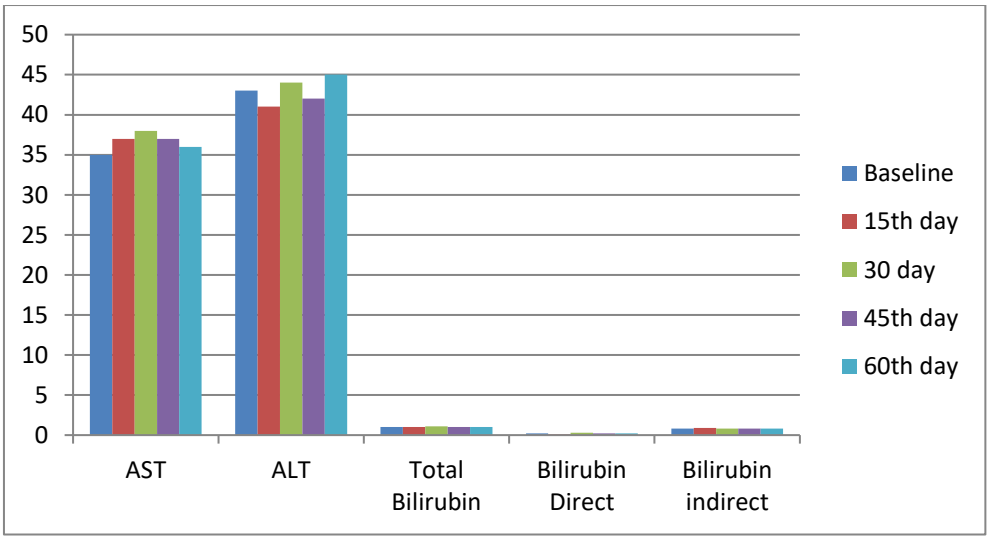

Figure- 4: Changes in Liver Profiles

DISCUSSION:

The 60-day study evaluating the effects of sun-dried tomato powder on glycemic, renal, and liver profiles demonstrated an improvement in the glycemic profile, while the renal and liver profiles remained stable from baseline to the 60th day of follow-up. This case study has been reported following the CARE checklist guidelines. The glycemic profile was assessed at two time points: baseline and the 60th day. A significant reduction was observed in fasting blood sugar (FBS), postprandial blood sugar (PPBS), and HbA1c levels, which decreased from 134 to 111 mg/dL, 171 to 148 mg/dL, and 7.1% to 6.9%, respectively.

Previous studies have indicated that lycopene supplementation helps improve antioxidant enzyme levels and reduce lipid peroxidation[18-19], as well as improve LDL oxidation[20]. However, earlier human studies showed that the consumption of lycopene supplements did not significantly improve fasting blood sugar (FBS) or HbA1c levels. In contrast, our case study demonstrated a notable reduction in FBS, postprandial blood

sugar (PPBS), and HbA1c after 60 days of intervention with sun-dried tomato powder. While limited research has been conducted on human populations, most studies have focused on animal models, highlighting the need for more human-based studies to validate these findings.

The renal and liver profiles were assessed at five time points: baseline, 15th day, 30th day, 45th day, and 60th day. Since the baseline values for both profiles were within normal ranges, no significant changes were observed by the 60th day. The renal and liver profiles were monitored every 15 days to evaluate potential hepatic or renal toxicity. It was found that administering 15 grams of sun-dried tomato powder posed no toxicity, aligning with findings from previous research. Additionally, a study suggested that lycopene supplementation can help prevent alcohol-induced hepatotoxicity in individuals with alcohol-related liver disease (ALD). [21] Since there is limited research on human populations, most studies have been conducted on animal models. One such study demonstrated that dietary administration of red and golden tomatoes in rat models with non-alcoholic fatty liver disease (NAFLD) led to reductions in body weight, decreased lipid accumulation in the liver, and improvements in the glycemic profile. These findings highlight the potential therapeutic benefits of tomatoes and their bioactive compounds, such as lycopene, in managing metabolic disorders.[22]

Saponins of tomato extract (STE) ameliorate the symptoms of oxidative stress, lipid metabolism disorders, visceral fat deposition and fatty liver disease. [14] Lycopene also helps in the decrease in Bcl-2-associated X protein and prevent Cisplatin-induced nephrotoxicity. [15] Lycopene helps in ameliorate crystal deposition, reduced oxidative stress, decrease inflammation and prevent kidney injury hence restores renal function. [16] The bioavailability of Lycopene is more in sun-dried tomatoes as compared to fresh ones. [17]

To the best of our knowledge, this is the first study to evaluate the effects of sun-dried tomato powder on glycemic profile, liver function, and renal function in individuals with type II diabetes. The patient showed significant improvement, and adherence to anti-diabetic medication was reduced. However, as this is a single case report, the findings cannot be generalized. Therefore, the results from this study should be carefully validated through larger-scale studies before making clinical recommendations.

CONCLUSION:

This case report suggests that sun-dried tomato powder can help improve the glycemic profile while maintaining renal and liver function in patients with Type 2 Diabetes Mellitus. However, to conclusively determine its efficacy as a safe and affordable intervention in clinical practice, larger, well-designed randomized controlled trials are needed.

Patient Perspective:

The patient was satisfied with the intervention provided by the Yoga and Naturopathy physician. He expressed his gratitude to the physician and was extremely happy with the improvement in his blood sugar levels, which have been well-maintained.

Informed consent: Written informed consent for publication of clinical details was obtained from patient.

Conflict of interest: The author declares that there is no conflict of interest.

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