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*Short communication*

# Total dietary carbohydrates, sugars and glycemic regulation in patients with type 2 diabetes mellitus

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## Introduction

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder characterized by impaired glucose metabolism and persistent hyperglycemia (ADA, 2024). Dietary habits, particularly carbohydrate and sugar intake, play an important role in glycemic regulation and diabetes management (Evert et al., 2019). Excessive consumption of refined carbohydrates has been associated with impaired metabolic regulation and an increased risk of T2DM and related metabolic disorders (Macdonald, 2016). Therefore, the aim of this study was to evaluate the impact of total dietary carbohydrate and sugar intake on glycemic status, assessed through glycated hemoglobin (HbA1c) and fasting glucose levels, in patients with T2DM.

## Materials and methods

A total of 130 patients diagnosed with type 2 diabetes mellitus (T2DM), aged 38–80 years, were recruited from the University Clinic for Endocrinology, Diabetes and Metabolic Disorders in Skopje, North Macedonia. Inclusion criteria included a confirmed diagnosis of T2DM for at least one year. Dietary intake data were collected using a food frequency questionnaire (FFQ), which included information on the frequency and quantity of consumed foods. Daily carbohydrate and sugar intake were calculated using food composition tables (U.S. Department of Agriculture, 2024) and expressed as g/day. Participants were categorized into low, medium, and high intake groups according to tertiles of carbohydrate and sugar intake. Glycemic status was assessed using glycated hemoglobin (HbA1c) and fasting glucose levels obtained from laboratory analyses and medical records. Descriptive statistics was performed and the results were expressed as mean ± SD. Differences between dietary intake groups were evaluated using one-way ANOVA with statistical significance set at $p < 0.05$.

## Results and discussion

Participants were classified into low (n = 44), medium (n = 44), and high (n = 42) total carbohydrate intake groups. For sugar intake, participants were classified into low (n = 45), medium (n = 42), and high (n = 43) intake groups. Mean HbA1c values did not differ significantly across total carbohydrate intake groups. Among the low, medium, and high total carbohydrate intake

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groups, mean HbA1c values were 7.6 ± 1.5%, 7.7 ± 1.7, and 7.6 ± 1.7%, respectively (p = 0.926). No significant differences were observed across sugar intake groups, where mean HbA1c values were 7.7 ± 1.7%, 7.6 ± 1.7%, and 7.5 ± 1.5% in the low, medium, and high intake groups, respectively (p = 0.815). Mean fasting glucose concentrations were also comparable across total carbohydrate intake groups, with values of 9.0 ± 3.9 mmol/L, 8.4 ± 3.7 mmol/L, and 9.0 ± 4.7 mmol/L in the low, medium, and high intake categories, respectively (p = 0.670). Likewise, fasting glucose levels did not differ significantly among sugar intake groups, with corresponding mean values of 8.9 ± 4.2 mmol/L, 8.7 ± 3.1 mmol/L, and 8.8 ± 4.9 mmol/L (p = 0.975).

The present study found no significant association between total dietary carbohydrate and sugar intake and glycemic regulation in patients with T2DM. Glycemic control is influenced by multiple factors, including pharmacological therapy, physical activity, disease duration, body composition, and overall dietary patterns (Evert et al., 2019), which likely explains the observed lack of association. In addition, continuous glucose monitoring (CGM) may better represent the effects of dietary carbohydrates and sugars on daily glycemic patterns (Ehrhardt and Al Zaghal, 2020). Total carbohydrate intake may also insufficiently reflect metabolic effects, as carbohydrate quality, glycemic index, glycemic load, and fiber intake have been shown to exert stronger effects on postprandial and long-term glycemic control than quantity alone (Reynolds et al., 2019). Accordingly, similar carbohydrate intakes may result in different glycemic responses depending on dietary composition. Our findings are consistent with reports demonstrating inconsistent associations between total carbohydrate intake and glycemic parameters in patients with T2DM (Evert et al., 2019). Furthermore, antidiabetic therapy and lifestyle modifications introduced after diagnosis may attenuate the direct effects of total carbohydrate and sugar intake on HbA1c and fasting glucose levels. Overall, the obtained results highlight the complexity of glycemic regulation in T2DM and emphasize the importance of considering both dietary and non-dietary factors when evaluating metabolic control in diabetic patients. This further supports the importance of individualized nutritional approach in the management of T2DM, taking into consideration overall dietary patterns and patient-specific metabolic characteristics.

## Conclusion

The glycemic status in patients with T2DM was not significantly influenced by total carbohydrate and sugar intake. This suggests that multiple interacting factors beyond carbohydrate consumption (lifestyle factors, pharmacological therapy) can affect glycemic control. Furthermore, HbA1c reflects average glycemic exposure and may not fully capture short-term glucose fluctuations induced by carbohydrate and sugar intake. Nevertheless, carbohydrate intake remains an important component of diabetes management and further studies considering CGM are required to elucidate the relationship between carbohydrates and glycemic regulation in patients with T2DM.

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