



NUTRITION AND GLYCEMIC MANAGEMENT IN TYPE 2 DIABETES

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History & Assessment

Patient is male in late-thirties, diagnosed with Type 2 Diabetes about 5 years ago. First presented to RD about 2 years ago.

Health history and psychosocial factors:

- > History of hypertension, hyperlipidemia, appendectomy, depression with suicidal ideation
- > Recent A1C was 7.7%; managed on metformin and glipizide
- > Unemployed and living with family, who provide food/meals
- > On Medicaid, which limits coverage for certain medications and devices

Diet and lifestyle:

- > Reported variable carbohydrate diet; usual pattern of three meals plus snack but could go a long time without eating before dinner
 - > Energy-dense, high-carbohydrate dinners in late evening
- > Walking 30 minutes per day
- > Stress regularly impacting ability to sleep

Initial Assessment: Routine with exercise; not routine with food timing or balancing protein, fat, and carbohydrate, resulting in high postprandial blood glucoses (BGs)

Diagnosis: Type 2 diabetes with no complications, without long-term use of insulin

Assessment at follow -up visits

Patient consistently sees his RD and PCP for support and education.

- > **Month 4:** food timing off; going up to 7 hours without food
- > **Month 7:** increase in drinking SSBs; working with therapist to set behavior-change goals
- > **Month 9:** no longer drinking SSBs; working on decreasing portions, eating more vegetables, and increased walking
- > **Month 14:** still struggling with motivation to change behaviors; starting to work with new therapist
- > **Month 21:** dealing with personal stressors impacting self-care behaviors; still working on food timing and portions but getting more protein and less carbohydrate

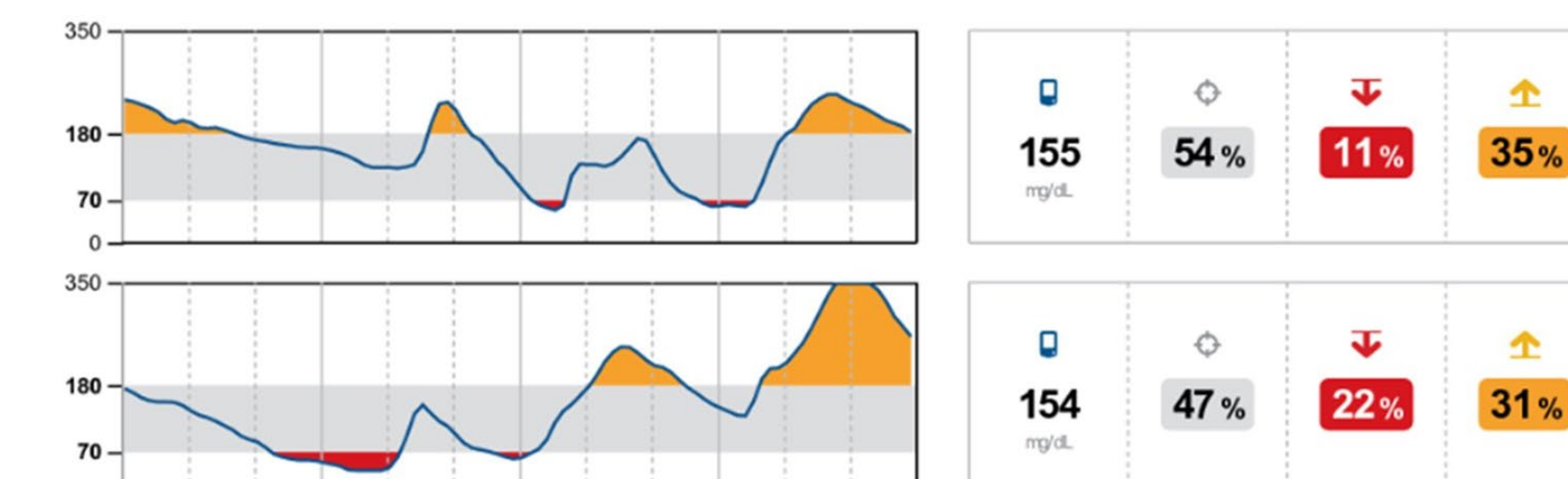
Medications

The PCP and RD have worked together closely on this case, discussing medication use and monitoring side effects. Patient's medications have included the following:

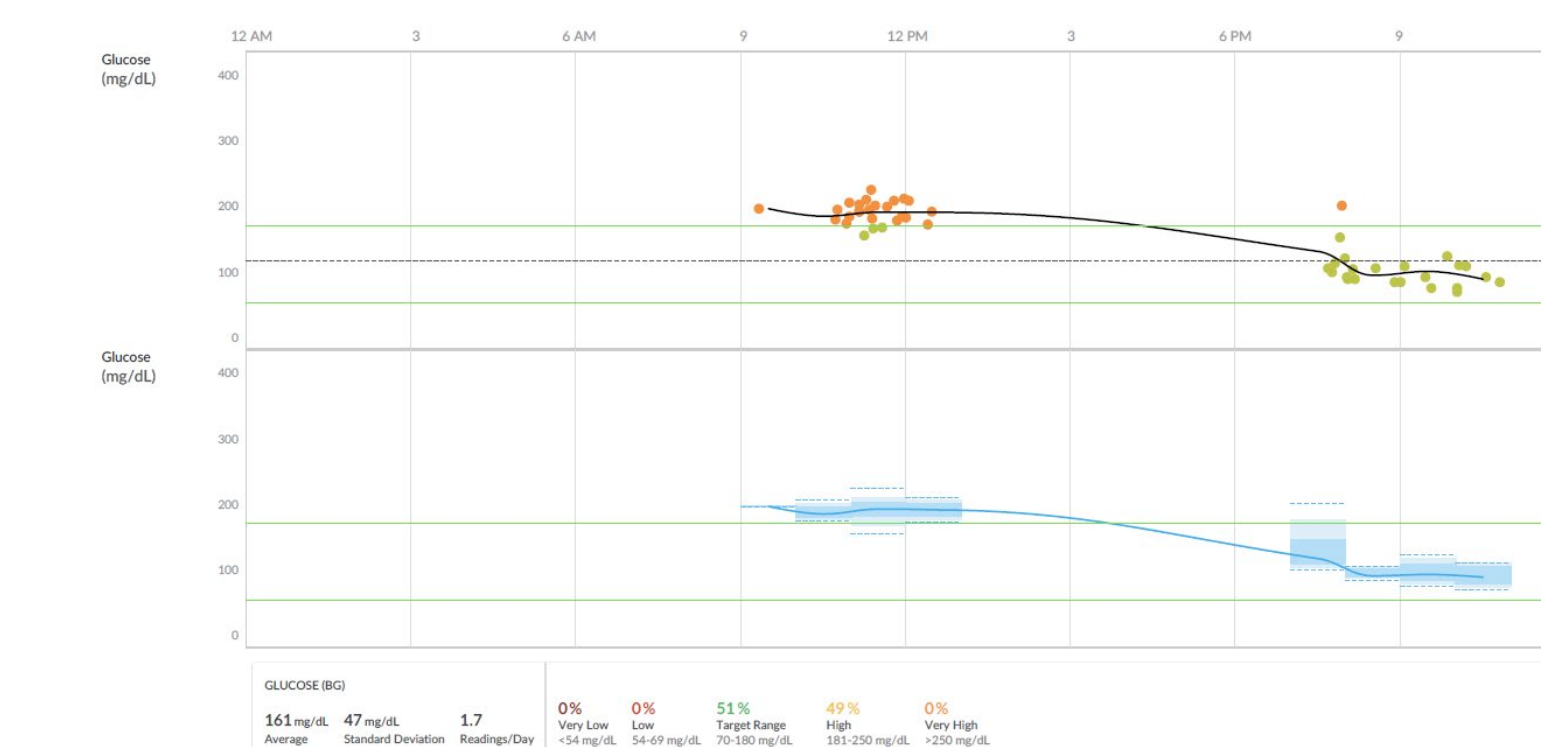
- > **Metformin:** decreases amount of glucose liver releases and intestines absorb, which can increase insulin sensitivity
 - > Potential side effects: nausea, vomiting, diarrhea, gas
- > **Glipizide:** a sulfonylurea, which stimulates insulin release from the pancreas
 - > Potential side effects: weight gain, **low blood glucose** (especially at risk if skipping a meal)
- > **Bydureon, Trulicity:** a glucagon-like peptide-1 agonist, which stimulates insulin from the pancreas, reduces glucose release from liver, slows stomach emptying, decreases appetite
 - > Potential side effects: **low blood glucose**, nausea, vomiting; GI upset caused by eating high-fat foods and eating beyond satiety

Interventions

- > Aim to eat about every 3-4 hours and soon after waking to help keep blood glucose levels more even
 - > Eat a snack if 5 or more hours between meals
- > Balance protein and carbohydrates at every meal and snack
- > Goal of less than 40 mg/dl rise in BG from pre- to post-meal
- > **Lower carbohydrate diet:** drink protein shakes before eating carbohydrates, particularly dinner, to help with satiety and limit carbohydrate intake
- > **Monitoring and evaluation** via BG meter and log



Example of two days' worth of BG data from a continuous glucose monitor (CGM).



Patient's meter data from 30 days leading up to appointment in Month 21.

Key Takeaways

- > MNT is a cost-effective component of diabetes care that can improve clinical outcomes and quality of life in individuals with diabetes.¹ However, **initiating a low-carbohydrate diet could have increased the risk of hypoglycemia** when medications were started and adjusted.
- > **Emerging research demonstrates low-carbohydrate diet can improve A1C, decrease fasting blood glucose, and decrease the need for glucose-lowering medications.**^{2,3} Using affordable protein supplements may be a way to help patients with limited income and barriers to change to lower their carbohydrate intake.
- > Continuous glucose monitors (CGMs) show blood glucoses over time, rather than at single points throughout the day.⁴ Medicaid only covers CGMs for individuals with diabetes taking insulin. **Diabetes-related policy efforts could improve CGM coverage for Medicaid patients.**

Month	Mo.1	Mo. 2	Mo. 4	Mo. 7	Mo. 9	Mo. 11	Mo. 13	Mo. 16*	Mo. 19	Mo. 21
A1C (most recent at time of visit)	7.7		7.5	7.5	7.8		7.8	7.4	7.4	7.5
Median BG	195	192	169	194	220.5	244	210	208*	-	178
Mean BG	179	193.6	161.2	167.6	178.2	211	194.2	207*	-	161
Std. Deviation	61.8	52.4	48.6	57.5	70.7	75	39.8	18.5*	-	47
Coefficient of Variation (%) [†]	34.5%	27.1%	30.1%	34.3%	39.3%	35.5%	20.5%	N/A	-	29.2%
% Above Target [^]	65.7%	79.2%	66.7%	58.6%	60.9%	64%	88.9%	100%*	-	49%
Lowest BG reading	76	90	81	87	66	86	87	143*	-	98

* The ADA recommends a coefficient of variation $\leq 36\%$, with the caveat that some data suggest that lower targets ($<33\%$) help to better protect against hypoglycemia for those receiving insulin or sulfonylureas.²
[^] Target range is between 70-180 mg/dl, and the goal is for TIR to be more than 70%.⁷ Therefore the goal for % Above Target is 30%.
^{*} Only testing at one time of day (late morning/early afternoon)

References

1. Powers MA, Bardsley JK, Cypress M, et al. Diabetes Self-management Education and Support in Adults With Type 2 Diabetes: A Consensus Report of the American Diabetes Association, the Association of Diabetes Care & Education Specialists, the Academy of Nutrition and Dietetics, the American Academy of Family Physicians, the American Academy of PAs, the American Association of Nurse Practitioners, and the American Pharmacists Association. *The Science of Diabetes Self-Management and Care*. 2020;46(4). doi: 10.1177/0145721720930959
2. van Zuuren EJ, Fedorowicz Z, Kuijpers T, Pijl H. Effects of low-carbohydrate- compared with low-fat-diet interventions on metabolic control in people with type 2 diabetes: a systematic review including GRADE assessments. *Am J Clin Nutr*. 2018;108:300-331. doi: 10.1093/ajcn/nqy096
3. Snorgaard O, Poulsen GM, Andersen HK, Astrup A. Systematic review and meta-analysis of dietary carbohydrate restriction in patients with type 2 diabetes. *BMJ Open Diabetes Res Care*. 2017;5(1). doi: 10.1136/bmjdr-2016-000354
4. American Diabetes Association Professional Practice Committee. 6. Glycemic Targets: Standards of Medical Care in Diabetes—2022. *Diabetes Care*. 2022, Jan 1;45(Supplement 1): S83-96. doi: 10.2337/dc22-5006