

# The Effect of Carbohydrate Recognition and Counting Ability on Glycemic Control in

## Pediatric Patients with Type 1 Diabetes

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### Introduction

Many factors contribute to the glycemic control in pediatric patients with type 1 diabetes mellitus (T1DM). Factors such as insulin dosage adherence, varying insulin requirements, understanding and adherence to diet, are well-studied factors in assessing glycemic control.

### Purpose

The purpose of this study was to determine if there was a significant correlation between the ability of our pediatric patients with T1DM to accurately recognize and count carbohydrates and their hemoglobin A1C (HgbA1C).

Demographics	
Female	26
Male	31
Race/Ethnicity	
Hispanic	14
Non-Hispanic Wh	21
Non-Hispanic Bl	21
Asian	1
Other <sup>2</sup>	1
Diabetes Treatment	
Insulin Pump	25
MDI	32

### Sample Ped Carb Quiz (PCQ) Questions

Does this food have carbohydrate? Please circle only one answer in this column.

- |              |     |    |            |                     |
|--------------|-----|----|------------|---------------------|
| 1. Bread     | Yes | No | Don't Know | Never eat this food |
| 2. Bagel     | Yes | No | Don't Know | Never eat this food |
| 3. Ice cream | Yes | No | Don't Know | Never eat this food |

How many grams of carbohydrates are in this portion of food?

- |                 |   |    |    |    |    |    |    |           |
|-----------------|---|----|----|----|----|----|----|-----------|
| 37. 1 cup milk  | 0 | 15 | 30 | 45 | 60 | 75 | DK | Never eat |
| 38. 1 cup pasta | 0 | 15 | 30 | 45 | 60 | 75 | DK | Never eat |
| 39. 1 cup OJ    | 0 | 15 | 30 | 45 | 60 | 75 | DK | Never eat |
| 40. 1 can soda  | 0 | 15 | 30 | 45 | 60 | 75 | DK | Never eat |

### Methods

- Data obtained during routine follow-up appointments with Pediatric Endocrinology at Rush University Children's Hospital.
- T1DM patients aged 12-17 years were asked to voluntarily complete the Ped Carb Quiz (PCQ).
- Patients treated either using insulin pumps or multiple daily injections of insulin (MDI) were included.
- Demographic (age, race, sex, insurance type) and clinical data (HgbA1C, insulin treatment, BMI percentile) were asked or extracted from the electronic health record.
- The subscales of Carb Recognition (score range 1 – 36) and Carb Counting (score range 1 – 6) were included from the Koontz PCQ.
- A higher score reflected more knowledge about what foods do and do not contain carbohydrate and grams of carbohydrate in different portion sizes of food.
- Spearman's correlation was conducted between HgbA1C, total PCQ score (range 1 – 42), Carb Recognition and Carb Counting.
- Mann Whitney U test determined if there were differences between scores and type of insulin treatment. Significance was set at  $p < 0.05$ .

#### References

- Koontz MB, Cuttler L, Palmert MR, O'Riordan MA, Borawski EA, McConnell J, Kern EO. Development and validation of a questionnaire to assess carbohydrate and insulin-dosing knowledge in youth with type 1 diabetes. *Diabetes Care*. 2010;33(3):457-462.
- Type 1 Diabetes in Children and Adolescents: A Position Statement by the American Diabetes Association 2018, <http://doi.org/10.2337/dci18-00232>

### Results

The sample included 57 subjects (26 females, 31 males)

- Median age of 14.5 (IQR 11.4, 17.2) years.
- Median BMI percentile was 72.3 (IQR 46.8, 93.5).
- About a third were categorized into the overweight and obese weight category (31%).
- Median HgbA1C was 9.2% (IQR 7.6, 10.4%).
- Subjects treated with insulin pump had a significantly higher total PCQ score (36.0 [IQR 32.0, 38.0]) compared to those treated with MDI (35.0 [30.0, 37.0]) ( $p = .002$ ).
- There was a negative and significant correlation between total PCQ score and HgbA1C ( $\rho = -0.312$ ,  $p = .037$ ) as well as Carb Recognition score ( $-0.297$ ,  $p = .045$ ).
- The carbohydrate recognition knowledge was higher in subjects treated with insulin pump even though the actual difference in scores was not of practice significance.

### Conclusion

This study supports that as carbohydrate knowledge increased, HgbA1C decreased. It is important to assess this knowledge at initial diagnosis and follow-up visits to better focus the nutrition education. Although not an initial objective, one finding from this study was that 31% of patients were overweight or obese. Lifestyle management that includes healthful approaches to nutrition and exercise is vital for healthy weight, CVD prevention and glycemic control in pediatric patients with T1DM (2).

