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Relationship Between Basal Insulin Requirement and Body Mass Index in Children and Adults With Type 1 Diabetes on Insulin Pump Therapy

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We write this letter as a brief report of our personal observation on the relationship between basal insulin requirement and body mass index (BMI) in children and adults with type 1 diabetes on insulin pump therapy.

In adults, the relationship between increased weight and insulin resistance is well established. Studies have also proven the coexistence of insulin resistance and hyperinsulinemia in preadolescent obese children.[1] Accordingly, it is plausible that higher BMI results in increasing basal insulin requirement. However, studies show contradicting results on the correlation between BMI and the basal insulin portion of the total daily insulin.[2-4] In the pediatric age group, it is recommended that basal insulin compose 30% to 50% of the total daily dose with consideration of the age-dependent circadian variations.[5] We hypothesize that higher basal insulin is required for patients with higher BMI, and we report our observation on the relationship in children and adults with type 1 diabetes on insulin pump therapy. We have looked at this relationship in a group of children and adults on insulin pump therapy. We have divided the subjects into normal and overweight based on their BMI. Children's classification into either normal weight, overweight, or obese was based on their BMI centile plotted in the CDC BMI chart. Basal insulin dose is considered high if it exceeds 50% of the total daily insulin. The observed population consisted of 50 children and 22 adults with type 1 diabetes on insulin pump therapy. Of the subjects, 63% were of normal weight and 37% were overweight. None were obese.

We observed no differences in the number of normal weight or overweight patients on basal insulin ratio of over 50%. This observation was seen in both children and adults. HbA1c, total daily insulin, and carbohydrate intake showed no significant difference in those with low basal insulin requirement compared to others with higher requirement. However, higher basal insulin requirement was observed in older children ($P = .031$) (Table 1).

Besides BMI, other factors influence basal insulin requirement. Meal content is shown to affect the bolus basal ratio of insulin. In a group of adolescents with type 1 diabetes from Japan, daily basal insulin dose was found to correlate with fat energy ratio of meals.[6] In our region, diet is rich in fat and high glycemic index carbohydrate. We have not looked at the meal contents in the observed population, but we assume that it might be a factor influencing the split of the total daily insulin into boluses and basal.

Table 1. The Association Between Basal Insulin Ratio and Continuous Variables: Age, HbA1c, Daily Insulin per kg Body Weight, and Daily Carbohydrate Intake in the Children Group.

	Basal insulin ratio	N	Median (range)	*P* value
Age	≤50%	24	10.5 (2.3-16.8)	.031
	>50%	26	12.9 (4.4-17.1)	
HbA1C	≤50%	24	8.2% (5.8-11.8) 66.1 mmol/mol (39.9-105.5)	.180
	>50%	26	8.6% (6.9-11.7) 70.5 mmol/mol (51.9-104.4)	
Daily insulin/kg	≤50%	24	0.84 (0.59-1.15)	.547
	>50%	26	0.87 (0.44-1.13)	
Daily CHO	≤50%	24	189.5 (95-401)	.159
	>50%	26	165.5 (79-330)	

Based on our observation, we conclude that BMI is not a predictive factor for basal insulin requirement in patients with type 1 diabetes. We highlight that puberty has an impact on basal insulin requirement regardless of the BMI, total insulin requirement, or daily carbohydrate intake. These clinical observations need to be confirmed on a larger

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population with consideration of meal contents and ideally by using a glucose clamp under controlled condition.

Abbreviations

BMI, body mass index; CDC, Centers for Disease Control and Prevention; HbA1c, hemoglobin A1c.

Declaration of Conflicting Interests

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