

The Effectiveness of Glucose, Sucrose and Fructose in Treating Hypoglycemia in Children with Type 1 Diabetes

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Abstract:

There is a lack of evidence regarding the most effective treatment option for managing naturally occurring hypoglycemia in children with type 1 diabetes. The objectives of this study were 1) To determine if sucrose and fructose are equally effective as glucose in the treatment of spontaneous hypoglycemia in children with type 1 diabetes. 2) To determine pre-study hypoglycemia treatment practices of children and teens with type 1 diabetes. An open labelled, randomized, cross-over design was used. Our main outcome was the effectiveness of treatment as defined by a blood glucose meter reading that is greater than or equal to 4.0 mmol/L (72 mg/dl) 15 minutes after treatment. Thirty-three subjects (age 5.4 to 15.5 yr of age and average duration of type 1 diabetes of 3.10 yr (SD=2.27)) participated. Each subject treated 5 hypoglycemic events with glucose, 5 with sucrose and 5 with fructose. For the purpose of this study BD glucose tabs® were used for the glucose source, Skittles® for sucrose and Fruit to Go® (fruit leather) for fructose. Significant difference between the effectiveness of the three treatments (Wilk's Lambda $F(2,28)=8.64, p=.001$). There was no significant difference between treatment glucose and sucrose, but that treatment fructose and sucrose were significantly different ($F(1,29)=16.09, p<.001$) and fructose and glucose were significantly different ($F(1,29)=15.64, p<.001$). The stated preferred treatment choices prior to the study were as follows: 36.4% glucose sources, 18.1% sucrose sources and 30.3% fructose sources. Approximate cost of treatment with BD glucose tabs® per treatment is \$0.90 compared to \$0.20 for Skittles® and \$0.60 for Fruit to Go®. In conclusion, Skittles® are as effective in treating hypoglycemia as more expensive BD Glucose tabs® in children with type 1 diabetes.

Background:

- There is a lack of evidence on treatment of hypoglycemia in pediatrics.
- 3 studies with adult samples indicate oral glucose is the best treatment (1-3).
- CDA & ADA recommend oral glucose (4,5).
- ISPAD recommends rapidly absorbed carbohydrate (6).
- Many patients report successful treatment with different types of rapid-acting carbohydrate.

Objectives:

1. To determine if sucrose & fructose are equally effective as glucose in the treatment of spontaneous hypoglycemia in children with type 1 diabetes.
2. To determine pre- and post-study hypoglycemia treatment preferences of children and teens with type 1 diabetes.

Methodology:

- Subjects 3-18 years of age with at least a 3 month history of type 1 diabetes.
- Open labeled, randomized, cross-over design.
- Each subject treated 5 hypoglycemic events with glucose (BD glucose tablets™), 5 with sucrose (Skittles™) & 5 with fructose (Fruit to Go™).
- Subjects ≤ 10 years of age treated with 10 gm of carbohydrate and those > 10 years of age treated with 15 gm.
- Hypoglycemia was defined as a blood glucose meter reading < 4.0 mmol/L (72 mg/dl) with effective treatment defined as ≥ 4.0 mmol/L 15 minutes after treatment.
- Pre & post study, participants reported their preferred treatment for hypoglycemia.

Statistical Analysis:

- Primary Hypothesis (effectiveness of sucrose, fructose & glucose): Repeated multiple analysis of variance in which the number of successes out of the five trials was the dependent variable and the within-subjects variable was the method of treatment (i.e. sucrose, fructose or glucose).
- Secondary Hypothesis (preferred treatment pre- and post-study): Frequencies of hypo treatment preferences.

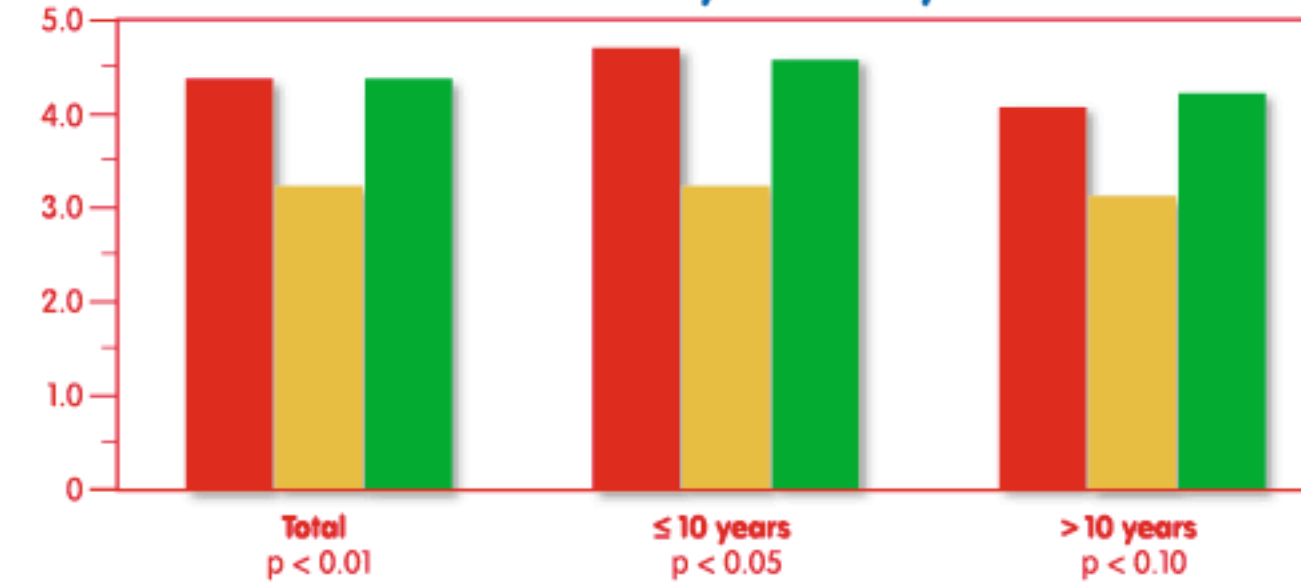


Results:

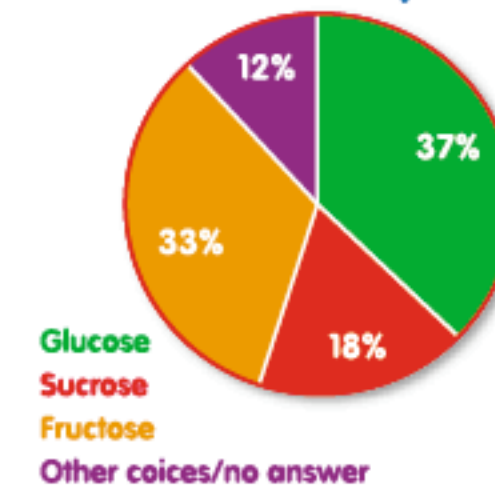
- 33 subjects (5.4-15.5 yr.) with average duration of diabetes 3.1 years (SD=2.27) participated.
- Significant difference between the effectiveness of the 3 treatments (Wilk's Lambda $F(2,28)=8.64, p<0.01$).
- No significant difference between glucose and sucrose
- Treatment effectiveness for fructose was significantly lower than sucrose ($F(1,29)=16.09, p<.001$).
- Treatment effectiveness for fructose was also significantly lower than glucose ($F(1,29)=15.64, p<.001$).

S Skittles
 F Fruit to Go
 G BD Glucose tablets

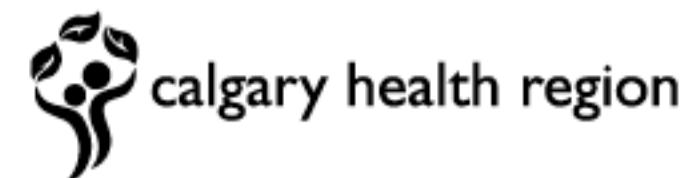
Number of Events Successfully Treated by Source



Treatment Preferences Pre-Study



Treatment Preferences Pre- versus Post-Study



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Discussion:

- Important factors in hypoglycemia treatment choices for children are taste, convenience, cost and portability.
- Cost analysis:
 - BD glucose tabs \$.90/treatment.
 - Skittles \$.20/treatment.
 - Fruit to Go \$.60/treatment.
- 35% changed to more effective treatment post-study.

Conclusion:

Skittles™ are as effective in treating hypoglycemia as more expensive BD Glucose Tabs™ in children and teens with type 1 diabetes.

References:

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