Metabolic and Glycemia Improvements Occur 3-Months Post Bariatric Surgery in Youth with Type 2 Diabetes
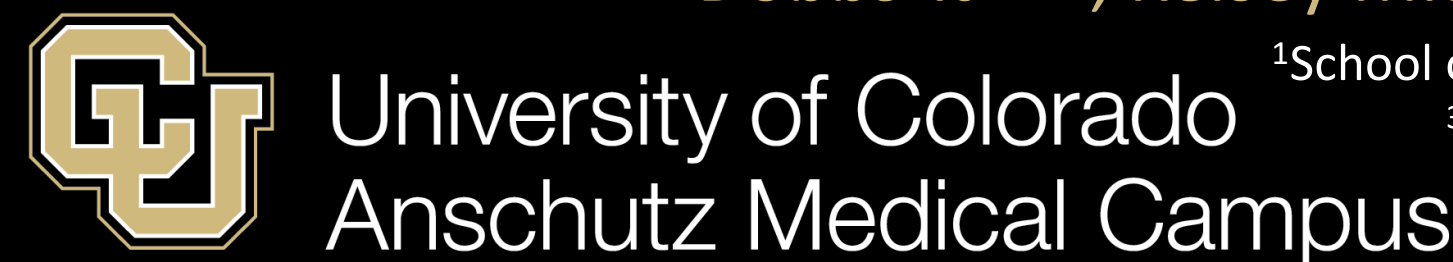
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Introduction

Background
- Rates of obesity and its related co-morbidities in youth such as youth-onset type 2 diabetes (Y-T2D) continue to rise in youth.
- Gastric bypass surgery improved dysglycemia in Y-T2D in the Teen-LABS study at 1 year and beyond, but the effect on metabolism and glycemia and underlying mechanisms in Y-T2D is unclear.
- Few data exist on the now more commonly performed vertical sleeve gastrectomy (VSG).

Research Aim:
- To determine the early effect of VSG on metabolism, hormone response to feeding and glycemia in Y-T2D.

Methods

Participants and Study Design:
- Adolescent youth with T2D ages 12-19 years undergoing VSG were recruited (n=14).
- Glycemic control, insulin sensitivity and secretion were assessed before and 3 months after VSG.
- Study visits occurred in the morning following an overnight fast.

Detailed Methods:
- Body mass and height were measured, BMI and BMI percentile calculated.
- A 4-hour liquid mixed meal tolerance test (MMTT, 45g CHO, 14g fat, 14 g protein) was performed with the following labs frequently sampled throughout the MMTT: glucose, insulin, c-peptide, free fatty acids, GLP-1, and PYY.
- Calculations included fasting HOMA-IR, Matsuda Index, oral disposition index, and MMTT area under the curve (AUC) for each lab.
- Statistical analyses were performed via GraphPad Prism 9.0. Changes in outcomes were tested using paired t-tests. AUC was calculated using the trapezoid rule. $p < 0.05$ was considered statistically significant.

Results

Variable (units)	Baseline	3-Month Post Surgery
Age (years)	17±1.7	17.3±1.5
Sex (m/f)	7/7	-
Race/Ethnicity Hispanic	11	-
Non-Hispanic		
White	2	
African American	1	
Height (cm)	169.5 ± 7.3	169.9 ± 7.3
Body Mass (kg)	134.5 ± 18.7	107.4 ± 15.7*
BMI (kg/m^2)	46.8 ± 5.5	37.2 ± 4.7*
BMI (% of 95th %ile)	161.8 ± 21	127.7 ± 20.1*
# Diabetes Meds		
0	0	12
1	6	2
2	6	0
3	2	0

Table 1. Participant demographics. Baseline and 3-month characteristics are presented as mean ± SD. *p<0.05.
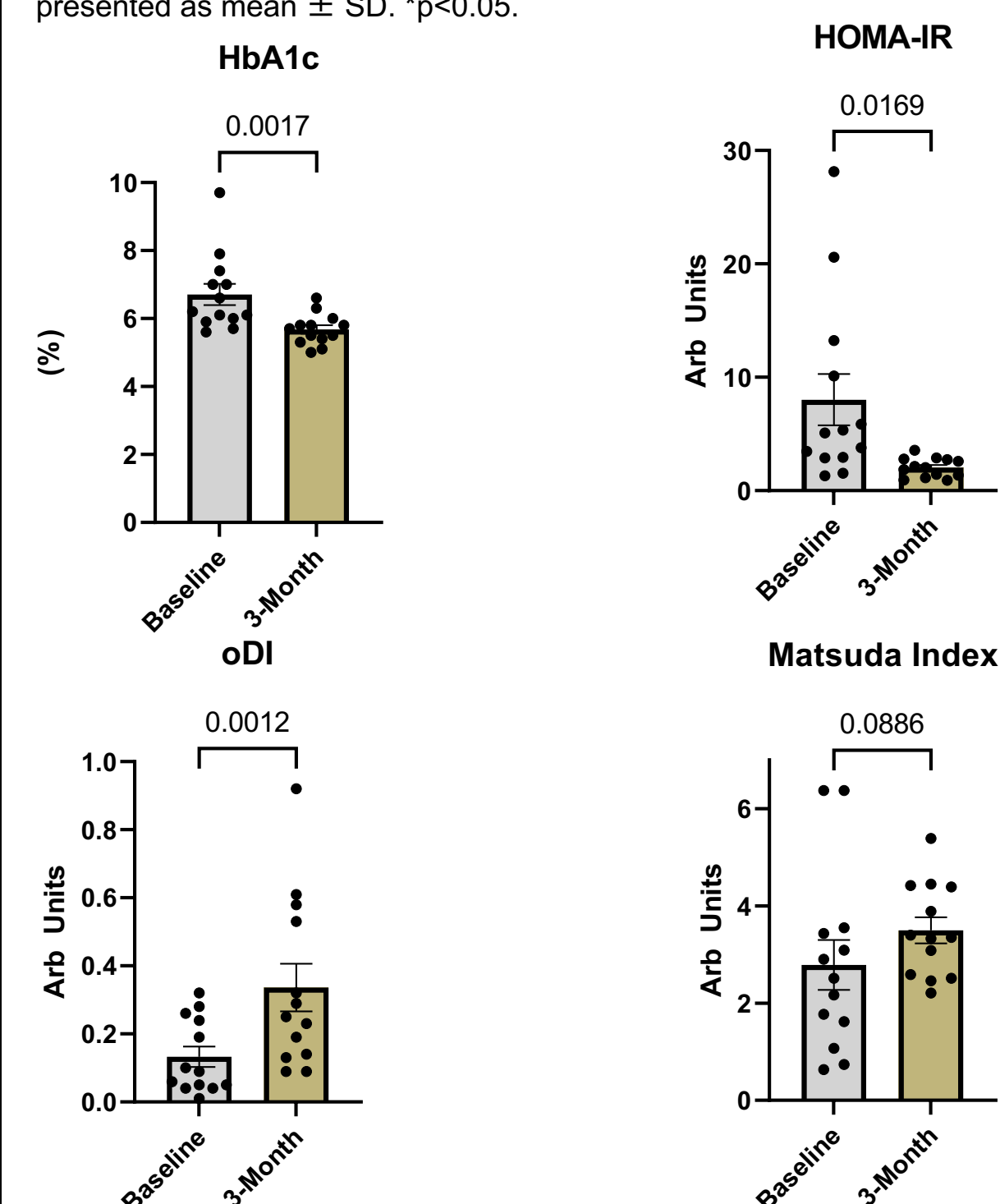

Figure 1. Surrogate Measures of Insulin Sensitivity and Secretion. Glycemia was assessed by participant HbA1c. Homeostatic Model Assessment for Insulin Resistance was calculated via fasting insulin and blood glucose levels. Oral Disposition Index and Matsuda Index were calculated by measuring changes in insulin and blood glucose levels during a MMTT. Data are presented as mean ±SEM. Significance set at p<0.05.
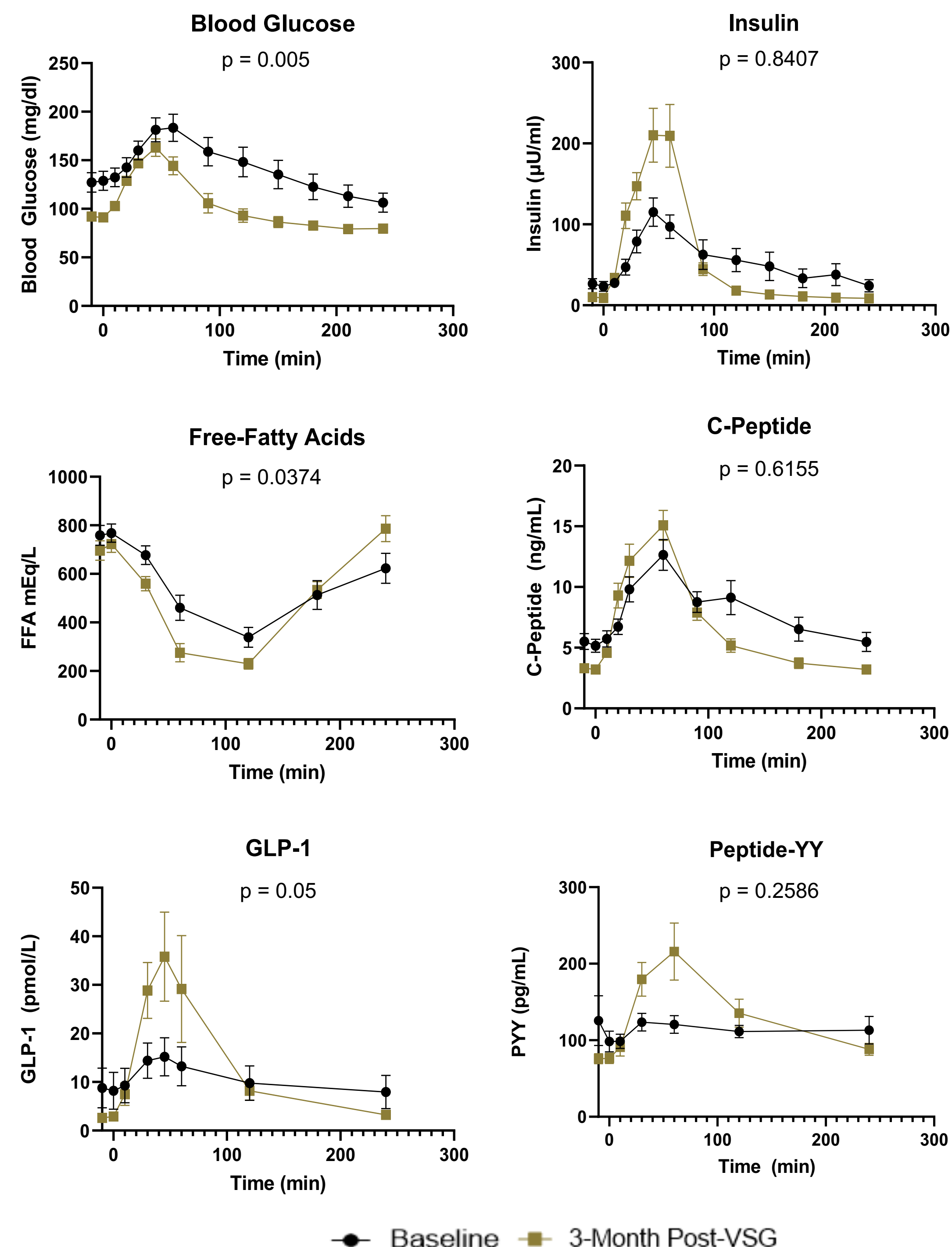

Figure 2. MMTT Results. Glucose, FFA, and GLP-1 AUC was significantly different at 3 months post-surgery. Insulin, C-peptide, and PYY AUC was unchanged at 3 months post-surgery. Data are presented as mean ±SEM. Significance set at p<0.05.

— Baseline   — 3-Month Post-VSG

Conclusions

- Within 3 months, VSG induced notable weight loss and improvements in glycemic control in youth with T2D.
- 86% of participants were no longer taking diabetes medications at 3 months.
- Changes were accompanied by improved insulin sensitivity and β-cell function.
- First phase insulin secretion appears to be the driver of improved insulin action, as demonstrated by the oDI and insulin and c-peptide kinetics during the first 30 minutes of the MMTT.

Future Directions

- Assess durability of improvements (1-year and 2-year follow up).
- Investigate underlying mechanisms driving improvements (MMTT incretin response)

Funding