

Hyperinsulinemia and Hypovitaminosis D Among Overweight Adolescents



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Background

In the past two decades, the prevalence of childhood obesity has doubled. Obesity, insulin resistance, and type 2 diabetes mellitus have been shown to be interrelated. Hypovitaminosis D has also been shown to be more prevalent in overweight patients. Because current studies regarding insulin resistance and hypovitaminosis D have focused on the adult population, we have chosen to examine the adolescent population in this study.

Purpose

To evaluate associations between hyperinsulinemia, vitamin D levels, and obesity in an adolescent cohort, as well as ensure the safety and efficacy vitamin D₂, 50,000 IU weekly therapy.

Methods

Subjects aged 10-18 years old attending the Adolescent Obesity and Diabetes Clinic were recruited to participate in a cross-sectional study. Body Mass Index (BMI), fasting serum insulin, pre- and post-therapy 25-hydroxyvitamin D and calcium levels were examined. Low serum 25-hydroxyvitamin D (hypovitaminosis D) was categorized as normal (≥ 30 ng/mL), insufficient (≥ 20 ng/mL), and deficient (< 20 ng/mL). BMI percentiles were classified as overweight ($> 85\%$) and obese ($> 95\%$). Patients with a fasting serum insulin level > 20 mc unit/mL were considered to have hyperinsulinemia. Spearman's rank correlation coefficients were computed and statistical significance was established ($p < 0.05$).

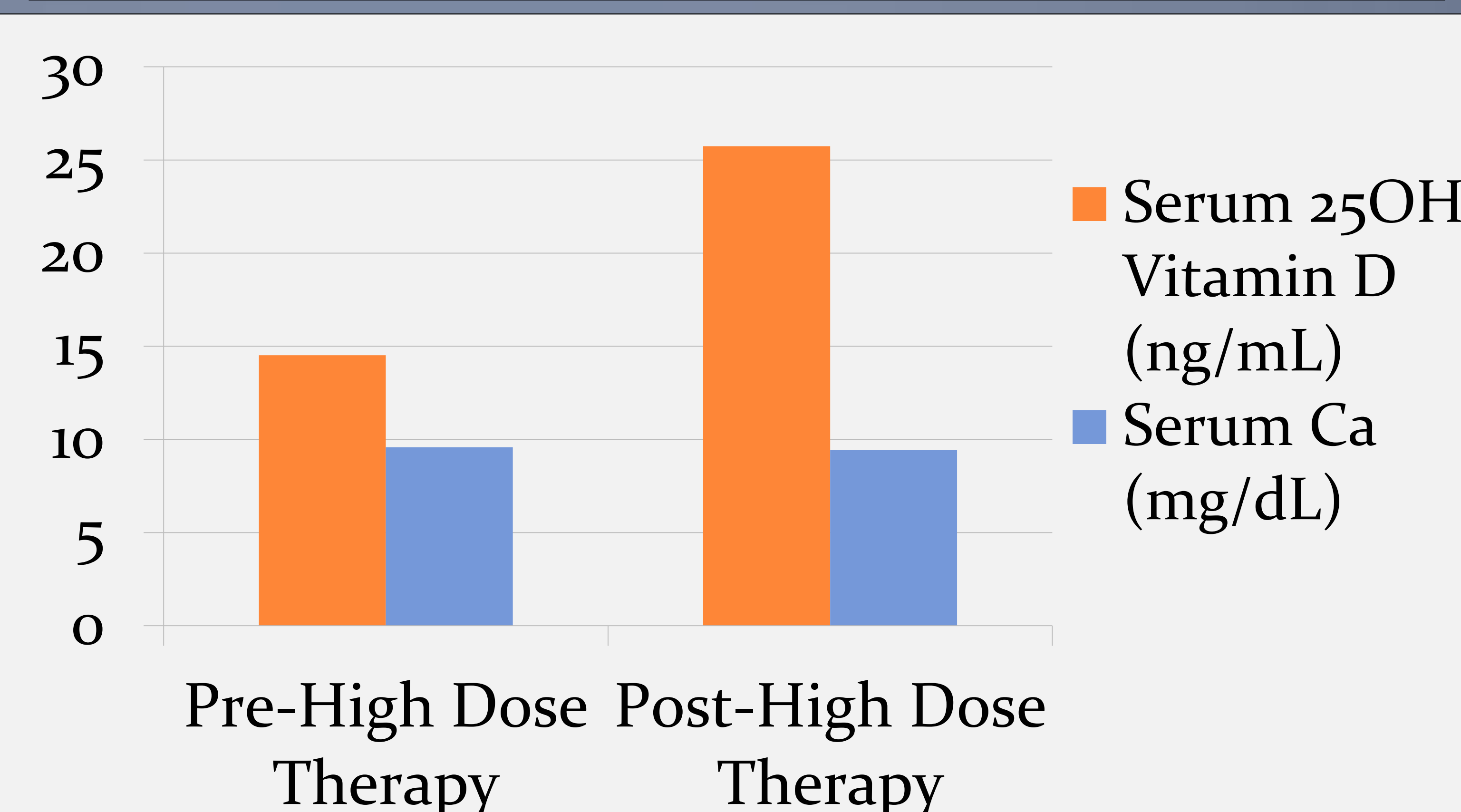
Results

The study included 297 adolescents, with mean age at first visit of 13.6 years. Among 195 subjects for whom initial fasting insulin levels were obtained, 59% had hyperinsulinemia. Mean 25-hydroxyvitamin D among 168 subjects was 23.0 ng/mL (SD 9.2), 70 (42%) were vitamin D insufficient, and 68 (40%) were vitamin D deficient (Table 1). Prior to treatment, mean serum 25OH vitamin D level was 14.52 ng/mL (SD 2.73) and calcium level was 9.58 mg/dL (SD 0.45). After 8 weeks of high dose therapy, mean 25OH vitamin D level was 25.74 ng/mL (SD 8.56) and calcium level was 9.44 mg/dL (SD 0.49) (Figure 1). Increased BMI was associated with increased fasting insulin ($r = .38$, $p = 0.0035$) and age ($r = 0.39$, $p < 0.0001$). Of the 227 subjects with multiple BMIs reported over time, 92 (41%) demonstrated BMI reduction.

Table 1.
Comparison of
Mean 25-
Hydroxyvitamin
D Levels

25OH Vitamin D classification	N	%
Normal (> 30 ng/mL)	30	18%
Insufficient (20-30 ng/mL)	70	42%
Deficient (< 20 ng/mL)	68	40%
Total	168	100%

Figure 1: Effect of High Dose Therapy on Serum 25-Hydroxyvitamin D and Calcium Levels



Interpretation and Future Plans

For patients who received high dose therapy, the improvement in the 25OH vitamin D level was significant ($p < 0.001$). There was no observed increase in calcium levels, so the high dose vitamin D₂ therapy was considered safe. A statistically significant association was found between BMI and hyperinsulinemia. These findings suggest that obesity may be a risk factor for hyperinsulinemia and hypovitaminosis D. Data suggests that weight stabilization and weight loss are reasonable and realistic goals in the context of a medical weight disorders clinic. A limitation of this study is the small sample size. Further investigation should be performed, including determining the effect of high dose vitamin D₂ therapy on BMI in adolescents.

References

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