

## Introduction

Type 1 diabetes mellitus (T1DM) is an autoimmune and inflammatory process. Vitamin D (VD) is thought to reduce inflammation and prevent autoimmune destruction. Research has shown that the VD receptor is present in osteoblasts, small intestine/colon, T and B lymphocytes,  $\beta$ -islet cells and most organs in the body. The presence of VD receptors on  $\beta$ -islet cells has prompted studies on the effect of VD levels on insulin sensitivity and requirements. Studies have shown that VD has an effect on insulin secretion and sensitivity in rats<sup>1</sup>. It has also been shown that adult type 2 diabetics with normal VD levels have decreased insulin requirements<sup>2</sup>. Another study showed that 1 year-old VD deficient children have been reported to be at a fourfold higher risk of developing type 1 diabetes than VD sufficient children<sup>3</sup>.

## Objectives

In this study, we aimed to determine if there is a significant correlation between VD levels and HbA1c, daily insulin requirement, BMI, and ethnicity in pediatric T1DM. Our hypothesis was that patients with low VD levels will have increased daily insulin requirement. Two prior studies in Turkey looked at the relationship between VD levels and daily insulin requirement in T1DM pediatric patients with contradictory results<sup>4-5</sup>.

## Methods

One hundred sixty two T1DM pediatric patients ages 3-20 years old were included in this study. Age, gender, ethnicity, BMI, HgA1c, VD level (1,25(OH)D), and total daily insulin requirement in units/kg/day were obtained through a retrospective chart review. VD levels were divided into 3 groups based on the Academy of Pediatrics recommendations on cut-off levels for states of VD<sup>6</sup>: <20 ng/ml was considered deficient/insufficient, 20-29.9 ng/ml low sufficient, and >30 ng/ml was high sufficient. Multivariate linear regression analysis (using STATA13.1) was used to assess the association between insulin requirement and VD levels adjusting for the following confounders: age, gender, ethnicity, BMI, and HA1c.

## Demographics

Gender	Number in Study
Female	84
Male	78

AGE	Years Old
Minimum	3
Maximum	20
Mean	13

Ethnicity	Number in Study
Caucasian	99
Hispanic	27
African-American	30
Not specified	6

## Results

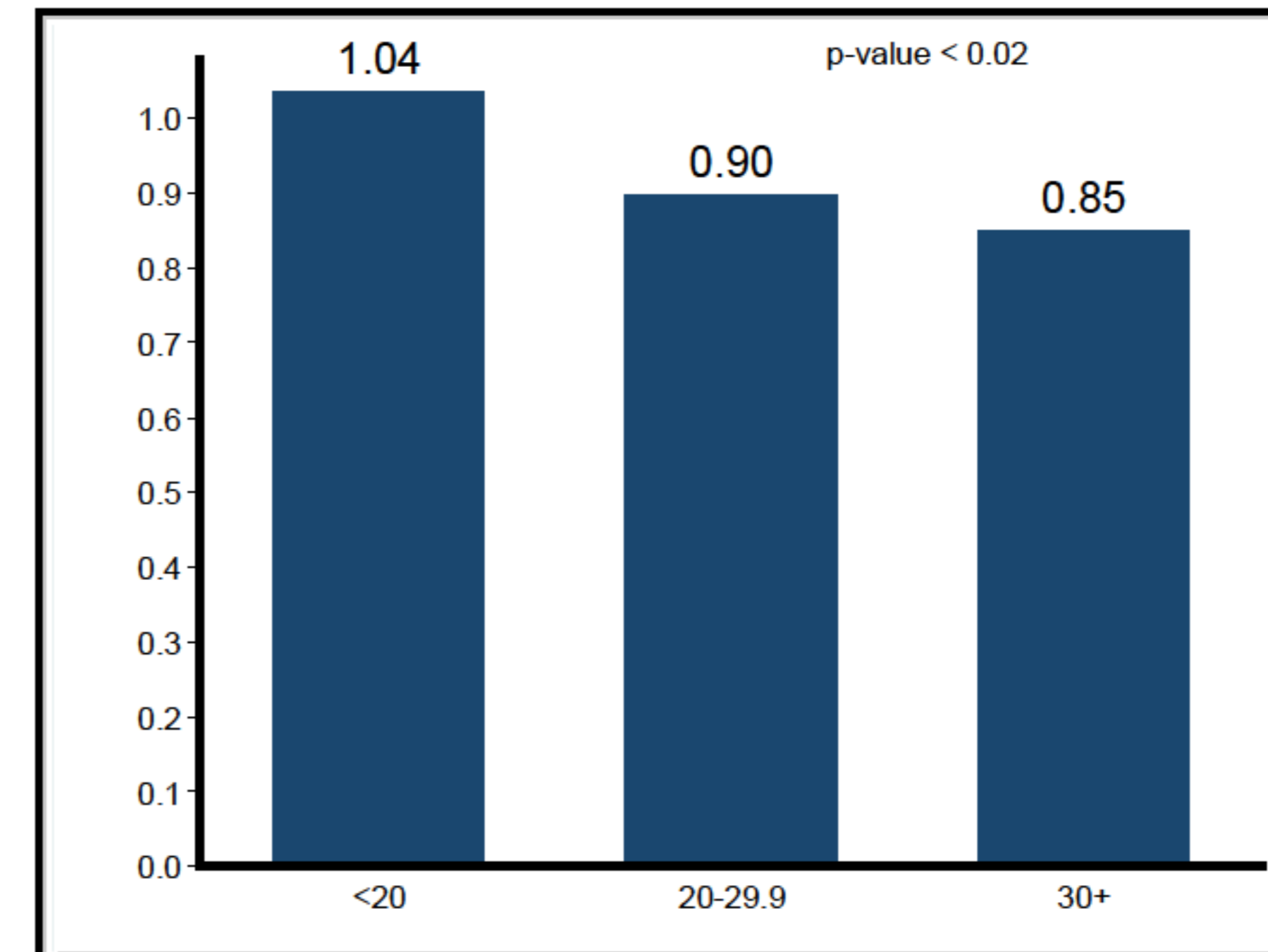


Figure 1: Correlation between daily insulin requirements and VD levels. VD levels were divided into 3 groups: 1) <20ng/mL (deficient/insufficient), 2) 20-29.9 ng/mL (low sufficient), and 3) >30 ng/mL (high sufficient). There is a significant relation between daily insulin requirement and VD level. Daily insulin requirement was higher in those with lower vitamin D levels with a p-value of <0.02.

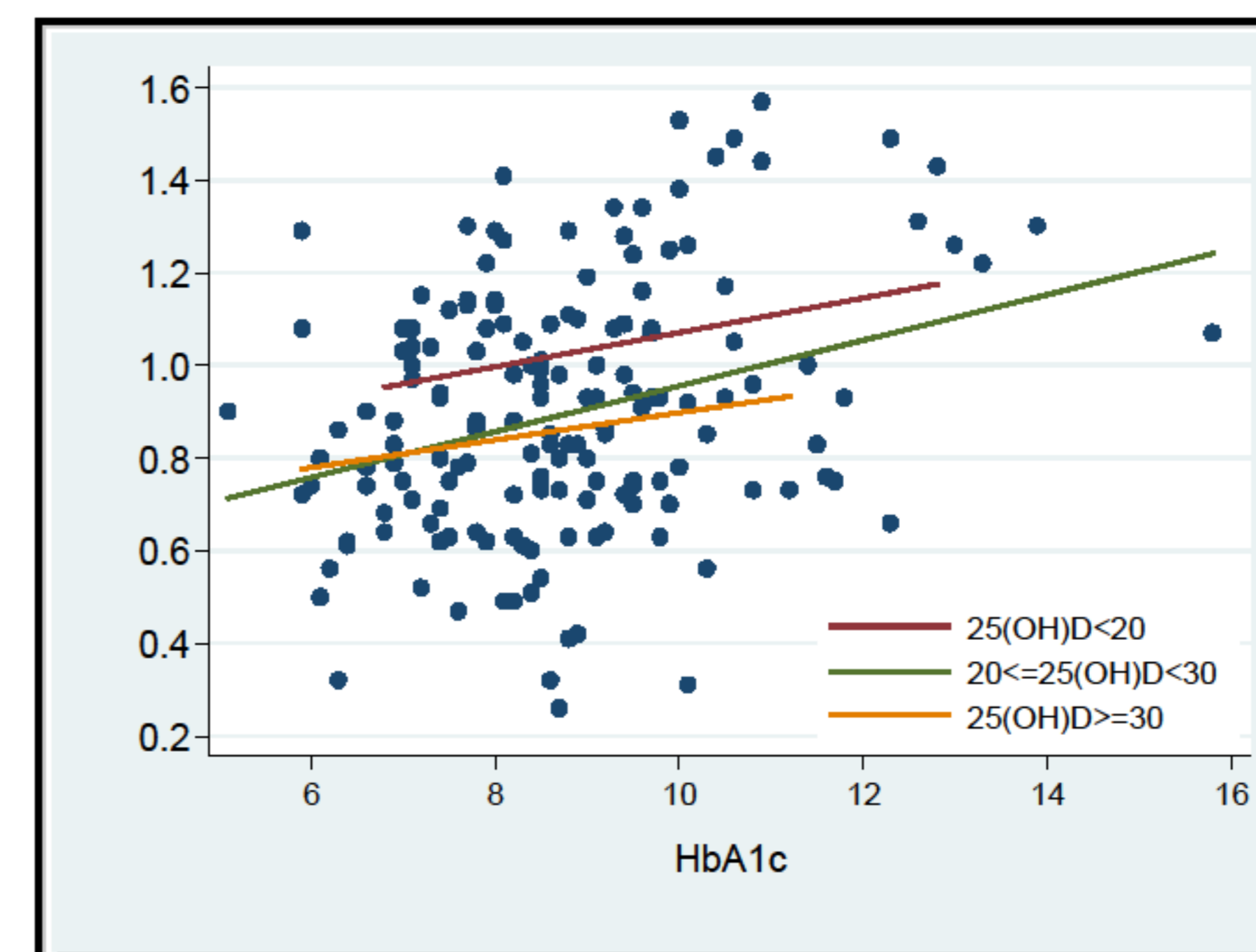


Figure 2: Multivariate linear regression analysis showed an association between insulin requirement and VD levels adjusting for the following confounders: age, gender, ethnicity, BMI, and HA1c. Significant increase in insulin requirement was only seen in the deficient/insufficient group. Low sufficient and high sufficient did not show a significant difference in insulin requirement.

## Discussion

The study included 84 girls (52%), 78 boys (48%), 30 African Americans (19%), 27 Hispanics (17%), and 99 Caucasians (61%). Mean age was 13. Analysis of the data showed that patients with deficient/insufficient VD levels had a statistically significant (P=0.02) increase in insulin requirement. Using multivariate linear regression analysis we were able to look at the relationship between daily insulin requirement and VD levels independent of HA1c levels, age, gender, ethnicity, and BMI.

## Conclusion

These findings suggest that lower levels of VD may contribute to the need for higher insulin doses, which may be related to insulin resistance and suboptimal glucose control in pediatric patients with T1DM. These results indicate that VD is related to T1DM control. We suggest checking VD levels and replacing VD in patients that are deficient/insufficient to improve glucose control and decrease insulin requirements.

## References

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