STRONG CHILDREN'S RESEARCH CENTER

Summer 2017 Research Scholar

Name: Roman Rahmani

School: University of New England COM

Mentor: David R Weber, MD, MSCE

ABSTRACT

Title: Assessment of Calcium Intake in the Pediatric Type 1 Diabetes Population

Background: Recent literature shows that patients with type 1 diabetes (T1D) have low bone density, and impaired bone quality and are at increased risk for bone fractures. Altered calcium metabolism resulting in excess urinary calcium excretion is one possible mechanism for these findings. Previously, we reported that poor glycemic control was associated with greater urinary calcium excretion in adolescents with T1D (Weber et al., 2016). Furthermore, because T1D incidence peaks during the critical age for bone accrual, a negative effect of hyperglycemia on calcium availability for bone mineral accrual may result in lifelong adverse consequences to bone health. Dietary calcium intake is a potentially modifiable factor affecting bone mineral accrual, yet there is little published data describing calcium intake in T1D. Given the necessity of an insulin injection with every meal or snack containing carbohydrates, it may be possible that patients with T1D are inclined to consume a different diet with varying amounts of calcium relative to the general population.

Objectives: To compare dietary calcium intake in the pediatric T1D population to that of similarly aged children without T1D and to identify risk factors for low dietary calcium intake in the T1D population.

Methods: A food frequency questionnaire (FFQ) adapted from the Nutrition Center, NIH clinical Center was used to determine calcium intake in 160 URMC T1D patients. Comparison groups included a group of 22 healthy siblings who also completed the FFQ and existing calcium intake data from the 2014 National Health and Nutrition Examination Survey (NHANES) collected via diet recall. T1D related characteristics were collected by interview and chart review. All data were assessed for normality prior to analyses, medians were compared by Wilcoxon rank sum, proportions by chi-square, and correlations by Spearman's rho. Potential outlying data points were tested for leverage (Hosmer/Lemeshow leverage) influence (Cooks D).

Results: The percentage of males in the T1D, and NHANES populations were 53.1% and 49%, respectively ($p>0.05$). The population of white individuals was 83% in the T1D and 24% in the NHANES population ($p<0.05$). The average age of T1D and NHANES participants was 15 and 13 y respectively ($p<0.05$). The unexposed siblings (US) group had an average age of 10 y, which was significantly different from the T1D group ($p<0.05$), and the T1D with siblings (T1DwS) group, which had an average age of 13 y ($p<0.05$). No difference in age existed between T1D and T1DwS groups ($p>0.05$) Both populations of US and T1DwS were 95% white, significantly different from the NHANES population ($p<0.05$). No significant differences were observed in race, or sex between the T1D, US and T1DwS groups ($p>0.05$). The NHANES group had a median dietary calcium intake of 927 mg, which was significantly lower than the T1D group, which had a median of 1574 mg ($p < 0.001$). A direct comparison between T1DwS and US showed no significant difference in calcium intake, 1712 mg vs. 1475 mg respectively (p

= 0.26). Additionally, compared to the other three groups, the NHANES population had 34% meeting the recommended daily allowance (RDA) of calcium compared to the T1D population which had 77% ($p < 0.05$). The US and T1DwS groups had 73% and 86% meeting the RDA, both significantly higher than NHANES ($p<0.05$). Within T1D participants, calcium intake was inversely associated with age ($R^2 = - 0.17$, $p = 0.04$), positively associated with growth ($R^2 = 0.33$, $P < 0.001$), and not associated with average A1c ($R^2= 0.02$, $P = 0.99$)

Conclusion: This study found that dietary calcium intake was greater in T1D and US from URMC compared to a nationally representative population of NHANES. There was evidence of a trend toward increased calcium intake in a subsample of T1D participants compared to US; the small sample size of this group may have limited our ability to detect a statistical difference. This study demonstrates that despite the fracture risks, nearly ¼ of the pediatric T1D population is not achieving the RDA of calcium. It was also found that calcium intake is inversely proportional to the age of the T1D population, despite the fact that bone accrual is ongoing throughout the entire age range of the population studied. Additionally, over 75% of this population did not meet the recommended guideline of sustaining an A1c below 7.5. Consequently, these combined factors may significantly increase the fracture risk within the T1D population. The methodology for obtaining the calcium intake differed between NHANES and the present study, which may explain the differences noted. However, diet recalls have been done on a sample of the T1D study population and preliminary studies suggest a strong relationship with the FFQs. Future diet recalls are planned to confirm that the FFQ and diet recall methods may be accurately compared.