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SCRC Abstract

Physical activity in Children and Adolescents with Type 1 Diabetes
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Background: Even though physical activity (PA) alone cannot maintain good glycemic control in patients with type 1 diabetes (T1D) without an individualized insulin regimen, the positive effects of PA on the overall health of the body are still present. Literature has shown that adult T1D patients do not participate in PA as often as non-diabetic adults. However, not much evidence is available on the amount of physical activity done by the T1D pediatric population.

Objective: To compare the frequency and type of PA pediatric T1D patients participate in compared to a healthy cohort from published literature. To examine the relationships between physical activity glycemic control and ankle muscle strength.

Methods: Two sets of T1D data were analyzed: an incident cohort (n=41) from the Children's Hospital of Philadelphia and a prevalent cohort (n=9) from Golisano's Children's Hospital. The incident cohort included data from the time of T1D diagnosis and again 12 months later. The prevalent cohort consisted of subjects with existing T1D. PA data were collected using the validated Slemenda Questionnaire and based on recall of exercise done in the past week (expressed as hrs/day). Activities were categorized as high or low impact. PA in the T1D cohorts was compared to published data from 657 healthy controls from the Bone Mineral Density in Childhood Study(1) Ankle muscle strength was additionally collected in the incident cohort using a Biodex Dynamometer in plantar- and dorsiflexion at 20 degrees (expressed as torque in ft-lbs). Standard summary statistics were used to characterize participants and compare groups. Significance was defined using a 2-sided p-valued of <0.05 for all analyses

Results: Mean age of the incident T1D cohort was 13.2 ± 2.8 yrs and did not differ from controls (13.7 ± 3.1 yrs); the prevalent cohort was older (17.9 ± 2.8 yrs, $p<0.01$). Compared to healthy controls, the incident T1D cohort had lower total (1.0 ± 0.7 vs 1.8 ± 1.2 h/d, $p<0.01$) and high impact PA (0.4 ± 0.5 vs 0.9 ± 0.5 h/d, $p<0.01$) at baseline. Both total and high impact PA in T1D subjects showed non-significant increases over 12 months, to 1.2 ± 1.2 ($p=0.06$) and 0.6 ± 0.7 ($p=0.06$) and remained lower than controls, but the percent of PA that was high impact increased from 38 ± 0.3 to $53 \pm 0.4\%$, $p=0.03$. Comparisons of prevalent T1D data to healthy controls showed no difference in total PA, but found that they spent less time in high impact PA (0.5 ± 0.8 vs 0.9 ± 0.5 h/d, $p=0.02$). PA was not associated with glycemic control at any time point in either cohort. Median muscle strength at T1D diagnosis was correlated with serum bicarbonate for both plantar- and dorsi-flexion ($R^2= 0.446$ and $R^2= 0.554$ respectively, $p<0.01$; and increased over the study period [10.6 (IQR: 4-18.6)] in plantar- and [3.1 (IQR:0.7-7.5)] in dorsi-flexion, $p<0.001$ for both. Muscle strength was not associated with glycemic control.

Conclusions: Upon diagnosis of T1D, pediatric patients participated in less physical activity than their healthy counterparts and this comparison did not change within the first year of diagnosis. Data from the prevalent cohort suggested that time spent in PA may normalize over time, however, this hypothesis is limited by the small size of the prevalent cohort. Muscle strength was inversely correlated with severity of T1D presentation, but increased over the first year. We were unable to show an effect of glycemic control on either PA or muscle strength.

References

1. Mitchell JA, Chesi A, Elci O, McCormack SE, Roy SM, Kalkwarf HJ, Lappe JM, Gilsanz V, Oberfield SE, Shepherd JA, Kelly A, Grant SF, Zemel BS. Physical Activity Benefits the Skeleton of Children Genetically Predisposed to Lower Bone Density in Adulthood. J Bone Miner Res 2016; 31:1504-1512