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EDITORIAL

Vitamin D Supplementation In Obese African American Children

Vitamin D deficiency (serum 25(OH)D < 20 ng/mL) is present in 30-90% of overweight and obese children living in the United States, with higher rates among American-American children [1]. The prevalence of vitamin D deficiency has been consistently reported to be higher among African-Americans in part due to the decreased efficiency of cutaneous vitamin D production by darker skin [2]. Other factors contributing to lower vitamin D status among African-Americans include genetic differences in proteins involved in the vitamin D synthesis pathway and vitamin D binding protein [3]. The reasons why obesity is associated with vitamin D deficiency are unclear but likely related to increased volume of distribution of circulating 25(OH)D and/or fat sequestration of vitamin D [4,5].

Of concern has been the association between vitamin D deficiency and metabolic syndrome, adiposity markers, and insulin resistance in adults and children [6,7,8,9,10]. Several prospective trials have been conducted to investigate whether vitamin D supplementation in obese children can reverse some of these associations. The initial studies established that much higher doses of vitamin D are necessary in obese children to raise serum 25(OH)D to greater than 30 ng/mL [11]. Studies conducted in overweight African-American children and adults indicated that at least 2,000-4,000 IU of vitamin D was necessary to increase serum 25(OH)D > 30 ng/mL [12]. However, despite intakes of at least 2,000 IU daily of vitamin D, studies examining the impact of correction of vitamin D deficiency in obese children have demonstrated mixed results with some studies showing a beneficial response in insulin sensitivity [13,14] and some showing no changes in insulin sensitivity [15,16].

In this issue of JCTE, two clinical studies are presented examining the amount of vitamin D necessary to correct vitamin D deficiency in obese African-American adolescents and the impact on of vitamin D supplementation on markers of insulin resistance. Magge et al. [17] conducted a randomized, double-blinded, controlled trial in 26 obese African-American adolescents with vitamin D deficiency (25(OH)D < 20 ng/mL) between the ages of 12-17. Subjects received either 1,000 IU or 5,000 IU of vitamin D daily for 3 months. Unfortunately, only half of the subjects who received 5,000 IU of vitamin D daily achieved a serum 25(OH)D concentration greater than 30 ng/mL. The authors did not see any differences in the two vitamin D supplementation groups in markers of inflammation (hs-CRP) or insulin resistance including HOMA-IR and adiponectin. Sethuraman et al. [18] conducted a similar study randomizing 29 obese African-American children ages 13-17 with vitamin D deficiency (25(OH)D < 20 ng/mL) to either 50,000 IU of vitamin D2 once a week (~7000 IU daily) or placebo for 12 weeks. The mean serum 25(OH)D concentration was much higher in the vitamin D supplemented group compared to placebo (32 ng/mL vs 12 ng/mL, p < 0.0001). Unfortunately, this study did not demonstrate any changes in HOMA-IR or insulin concentrations after intervention with vitamin D or placebo.

These two studies highlight the challenges surrounding vitamin D repletion in obese African-American children. In the study by Sethuraman et al, the amount of vitamin D (~7,000, a dose equivalent greater than 10 times the RDA for vitamin D in children) provided to obese African-American subjects increased serum 25(OH)D concentrations just slightly above 30 ng/mL. Still, up to a third of the subjects given vitamin D did not achieve a sufficient serum 25(OH)D concentration. Since this was a relatively short study of 12 weeks in duration, many subjects were likely still vitamin D insufficient during most of the study. A similar pattern of serum 25(OH)D was seen in the study by Magge et al where half of the subjects remained vitamin D insufficient on 5,000 IU of vitamin D daily. Both studies did not show any significant changes in markers of insulin resistance. These negative findings could be due to the inadequate dosing of vitamin D or a short follow-up period. Kelishadi et al found in 50 obese children randomized to vitamin D 300,000 IU delivered one to rapidly correct vitamin D status or placebo significant improvements in HOMA-IR and insulin concentrations in only the group receiving vitamin D [14]. Belenchia and colleagues studied obese adolescents randomized to 4,000 IU of vitamin D or placebo and observed significant changes in HOMA-IR after 6 months as well significant decreases in fasting insulin levels [13].

There remains a great deal of interest in studying the relationship between vitamin D status and insulin resistance in obese children and adults based on epidemiologic and observational studies. Randomized clinical trials to date have not been consistently able to demonstrate a benefit of vitamin D supplementation on makers of insulin resistance. Some of the challenges have included inadequate dosing of vitamin D to achieve serum 25(OH)D concentrations > 30 ng/mL and short duration of the trials. An important question is the timing of vitamin D intervention. Given the strong associations between vitamin D deficiency and disease, a better public health strategy may be to prevent vitamin D deficiency. Chronic vitamin D deficiency may be associated with changes in insulin resistance that may not be reversible in short term studies. Given the already known associations between vitamin D and calcium homeostasis and skeletal health, ensuring that obese children have more than adequate vitamin D status and improved lifestyle and nutrition throughout life seems to be a better approach to prevent insulin resistance and diabetes.

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