CHILDREN MAY NEED HIGHER VITAMIN D LEVELS THAN ADULTS FOR OPTIMUM BONE HEALTH

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Introduction

***Problem*:**

- Optimal levels of 25-OH-Vitamin D (25-OH-D) for children are unknown. Creating normal levels is problematic since the optimal level of vitamin D is not based on its level in the population.
- Tests of bone health, e.g. Dual Energy X ray (DEXA) scans (1) are performed infrequently in childhood and therefore effects of Vitamin D on direct measures of bone strength in large cohorts are unavailable.

Basis for Our solution :

- Serum phosphorus is known to increase with increasing levels of vitamin D (2) and the product of calcium X phosphorus has been positively correlated with bone strength. Correlations of calcium, phosphorus calciumXphosphorus product and parathyroid hormone with 25-OH-D can be used as surrogates for the correlation beteween bone strength and 25-OH-D.

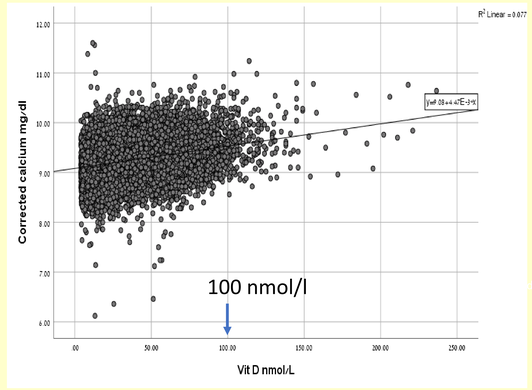
Subjects and methods

- Observational retrospective "big data" study, based on the Clalit Health Services (CHS) Jerusalem district database between 2010-2019.
  Total number of samples : 49,358
- Parameters tested: 25-OH-D, serum phosphorus, total protein, albumin, parathyroid hormone (PTH), serum calcium – all taken in the same sample.
- Age: 1 month to 18 years
  Excluded: 2836 samples of children with the following: Osteogenesis imperfecta (excluded from all calculations except PTH), Parathyroid disorders, gross liver enzyme disorders (X5 from upper limit) and kidney dysfunction- serum creatinine > 1 mg/dl.
  In view of the retrospective design, apart from 25-OH-D a different number of samples were available for each parameter for study.
- Pearson's and Spearman's correlation coefficients were calculated to determine the strength of the correlation between 25-OH-D and each parameter.
- Ethics: Approved by institutional review board of Clalit Health Services. Data retrieval and analyses were computerized and anonymous.

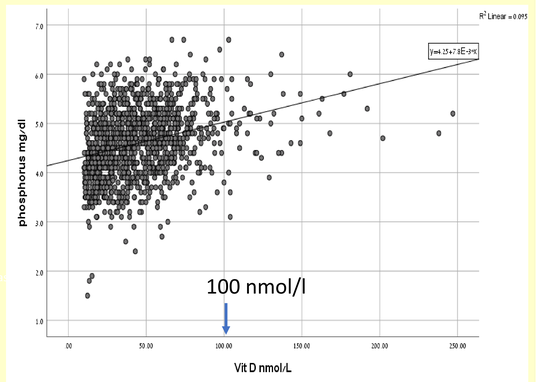
Results

There was a positive correlation between 25-OH-D levels and each of the parameters tested.
The levels at which increase in 25-OH-D continued to cause significant alteration in the corresponding parameter were:

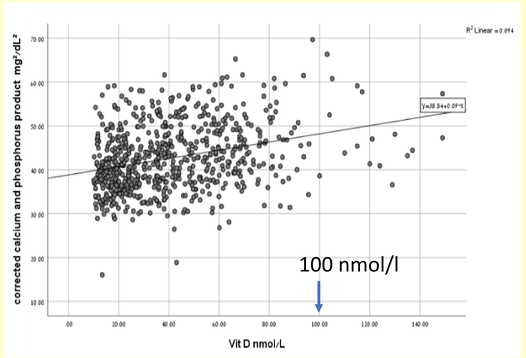
- For calcium – beyond 100 nmol/l (40 ng/ml)
- For phosphorus up to 100 nmol/l (40 ng/ml), beyond this there was no further increase
- For PTH there was a significant negative correlation up to 100 nmol/l. Beyond this, the trend continued but the numbers were too small to reach significance.
- For the calciumXphosphorus product there was a significant positive correlation between the calcium x phosphorus product with a significant trend. There were sufficient data up to 100 nmol/l.



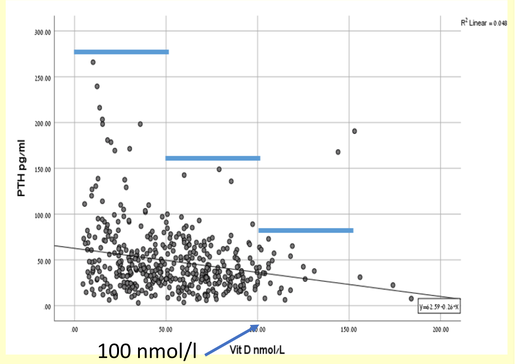
25-OH-D Vs corrected calcium



25-OH-D Vs phosphorus



25-OH-D Vs calcium phosphorus product



25-OH-D Vs PTH

Discussion

- We studied a large cohort and evaluated serum levels of corrected calcium, phosphorus and PTH with the aim of defining optimal levels of 25-OH-D for children. Our major findings were a positive correlation between all parameters and 25-OH-D that was statistically significant until 100 nmol/l .
- Previous studies did not reach clear recommendations because of different aims and, for the most part, smaller sample sizes. Kang et al. showed in 193 children that the calcium level increased greatly as 25-OH-D levels increased until 20 ng/ml (50 nmol/l) and continued to increase more gradually until 40 ng/ml (100 nmol/l)(3). A study from Saudi Arabia of 2110 children reported a high prevalence of vitamin D insufficiency and deficiency with a clear correlation between 25-OH-D and calcium levels but the limits of this correlation were unclear(4).
- In our study, the phosphorus increased significantly up to 100 nmol/l. Kang et al. showed a bimodal response with increasing phosphorus up to 50 nmol/l and then a moderate decrease as Vit-D increased(3).
- The calcium X phosphorus product appears to be a significant parameter in bone metabolism since it has been reported low in osteoporosis(2). Here it appears to correlate well with 25-OH-D levels.
- We showed that PTH levels decline as 25-OH-D levels increase and this trend continues at least until a Vit-D level of 100 nmol/l. A study from Turkey describes a similar phenomenon to our findings, i.e. a decline in PTH up to 75 nmol/l with modest further reduction beyond that (5).

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Bone, growth plate and mineral metabolism

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