DOI : 10.35124/bca.2019.19.2.3553

Biochem. Cell. Arch. Vol. 19, No. 2, pp. 3553-3557, 2019 | www.connectjournals.com/bca | *ISSN 0972-5075*

THE RELATIONSHIP BETWEEN VITAMIN D CONCENTRATION AND SOME BIOCHEMICAL PARAMETERS IN PATIENTS SUFFERS FROM VITAMIN D DEFICIENCY AT KIRKUK CITY

Hayder Mudheher Abbas, Marwa Adnan Hasan and Sinor Dalshad Ali

Department of Biology, College of Science, Tikrit University, Tikrit, Iraq.

(Received 21 May 2019, Revised 27 July 2019, Accepted 14 August 2019)

ABSTRACT : Vitamin D is a fat-soluble steroid hormone. It is the only form produced cutaneously while exposure of plants steroids and ergosterol to UV lights forms Vit D2.2, also it obtained from foods or by synthesis in the skin after sunlight exposure (Ultraviolet rays) and converted to the active form in the liver and kidneys. The aim of this study is to find and to prove the relationship between vitamin D and some chemical parameters. Use Chemiluminescence Immunoassay System (CL-1000i - Mindray) for PTH and vitamin D analysis, while other parameter's (Alkaline phosphatase, Calcium and phosphorus) use Clinical Chemistry Analyzer (BS-240 Mindray). This study showed a significant deference between vitamin D and Alkaline phosphatase, which is represented inverse relationship. Simple differences has been found in other parameters, but not significant differences, while others did not show any differences.

Key words : Biochemical parameters, vitamin D, chemiluminescence immunoassay system, sunlight exposure.

INTRODUCTION

Vitamin D is a fat-soluble steroid hormone. Is the only form produced cutaneously while exposure of plants steroids and ergosterol to UV lights forms Vit D2.2, also it obtained from foods or by synthesis in the skin after sunlight exposure (Ultraviolet rays) and converted to the active form in the liver and kidneys (McCarty *et al*, 2013). Vitamin D deficiency (<20 ng/mL), leads to defective bone mineralisation and decreased bone mineral content (Kota *et al*, 2013). The deficiency is rising in correspondence with increasing exclusive breastfeeding rates, breast milk being a poor source of vitamin D and inadequate vitamin D supply would imply defective bone mineralization (Streym *et al*, 2015; Leerbeck and Søndergaard, 1980). Its prevalence in term healthy breastfed infants has been reported variably as 20-82% in various studies (Dawodu *et al*, 2003 and Wagner *et al*, 2010). Breast milk contains 15-50 IU/L vitamin D, which is insufficient to meet the needs of neonates (Streym *et al*, 2015; Leerbeck and Søndergaard, 1980). It was felt that there is a requirement of Indian studies in the matter given that the handling of vitamin D in the body differs in the people of different races, colour and ethnicity. The presence of dark skin, decreased activity of 25(OH) hydroxylase (an enzyme involved in the synthesis of an active form of vitamin D) in Asian population lack of fortification policies in India predispose mothers and their infants to vitamin D deficiency (Sachan *et al*, 2005).

Parathyroid hormone (PTH) and vitamin D are major regulators of mineral metabolism and form a tightly controlled feedback cycle; PTH stimulates 1,25-dihydroxy vitamin D synthesis, which in turn exerts a negative feedback on the parathyroid glands (Metzger *et al*, 2013 and Khundmiri *et al*, 2016). Parathyroid hormone is synthesized by the parathyroid gland and maintains the short-term homeostasis of ECF-Ca2þ through its effects on the kidney (increased calcium re-absorption) and mobilization of calcium from the labile bone pool. A more sustained response is produced through the regulation of the renal production of 1,25(OH)2D (Parfitt, 1987). Parathyroid hormone is the major regulator of 1,25(OH)2D production, although serum calcium and serum phosphate also affect its production. The homeostasis of extracellular ionized plasma calcium (ECF-Ca2þ) is tightly regulated by a number of hormones, of which parathyroid hormone and vitamin D play a major role (Fig. 1).

Alkaline phosphatase is a membrane bound enzyme which occurs in almost all living organisms. Residues involved in the active site of the enzyme and the ligands coordinating the two zinc atoms and the magnesium ion are conserved; thus, the catalytic mechanism is considered to be similar in prokaryotic and eukaryotic APs, but Mammalian APs have low sequence identity

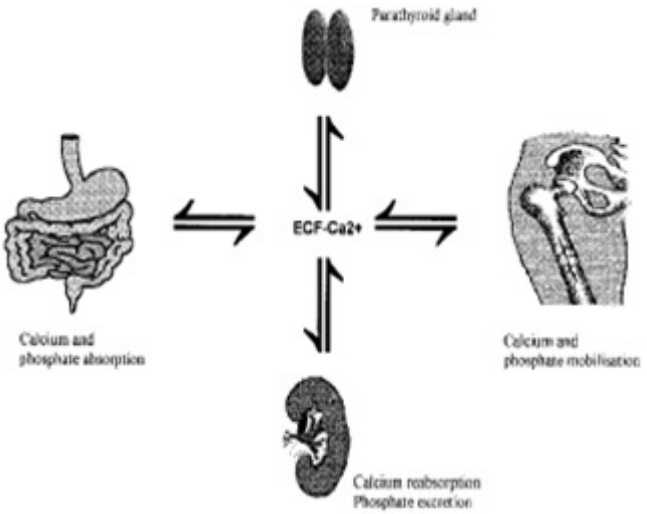

Fig. 1 : The parathyroid hormone – vitamin D axis.

with *E. coli* (Kim and Wyckoff, 1991 and LeDu *et al*, 2001).

Calcium ions (Ca^{2+}) plays an important role in the cell wall and membrane as counteracting ions for inorganic and organic anions in the vacuole. These ions regulate physiological processes, including root hair elongation, pollen tube growth, and stomatal guard cell movement, and serve as an intracellular messenger in the cell (Kirkby and Pilbeam, 1984 and Pauly *et al*, 2000).

MATERIALS AND METHODS

200 samples have been collected from both sexes, this samples were taken randomly from patients suffers from vitamin D deficiency at Kirkuk city in the period from February 2019 to July 2019. All samples were taken from adults with the age range 20-45 years, the samples were centrifuged within 1.5 h of collection and used directly for assays for PTH (whole PTH) and vitamin D using the Chemiluminescence Immunoassay System (CL-1000i - Mindray), while the assays of other parameters (Alkaline phosphatase, Calcium and phosphorus) were analized by Clinical Chemistry Analyzer (BS-240 Mindray).

RESULTS

Table 1 shows the measurements of all parameters used in this study which include (Minimum, Maximum, Mean, Std. Error of Mean and Std. Deviation) while Table 2 shows the correlation between vitamin D with other parameters and also among the parameters themselves.

- **Relationships between vitamin D and calcium**

The results showed no significant differences between vitamin D and calcium, as shown in Fig. 2 the value of calcium has remained almost constant at the decrease or increase in the value of vitamin D.

- **Relationships between vitamin D and parathyroid hormone**

The results showed simple differences but not significant between vitamin D and Parathyroid Hormone, as shown in Fig. 3, the value of Parathyroid Hormone has a little change when vitamin D value at a decrease or increase.

- **Relationships between vitamin D and alkaline phosphatase**

The results showed significant differences between vitamin D and Alkaline phosphatase, as shown in Fig. 4, which is an inverse relationship, where when the vitamin D decreases Alkaline phosphatase increases and vice versa.

- **Relationships between vitamin D and phosphorus acid**

The results showed no significant differences between

Table 1 : Measurements of all parameters.

Parameter	Average age	Minimum	Maximum	Mean	Std. Error of Mean	Std. Deviation
Vitamin D	32.5	6.10	33.10	17.8811	1.26545	8.58267
Calcium		7.90	9.20	8.5159	.04912	.33313
Parathroid Hormone		12.20	55.80	36.3609	1.69524	11.49766
Alkaline phosphatase		1.70	130.00	69.5826	4.29094	29.10259
Phosphorus		2.10	4.80	3.3087	.11037	.74858

* Represent significant differences.

Table 2 : Correlation between parameters.

Parameter	Vitamin D	Calcium	Parathroid Hormone	Alkaline phosphatase	Phosphorus
Vitamin D	1	0.114	0.128	-.374-*	0.059
Calcium	0.114	1	0.192	-.162-	0.013
Parathroid Hormone	0.128	0.192	1	-.095-	0.204
Alkaline phosphatase	-.374-*	-.162-	-.095-	1	0.049
Phosphorus	0.059	0.013	0.204	0.049	1

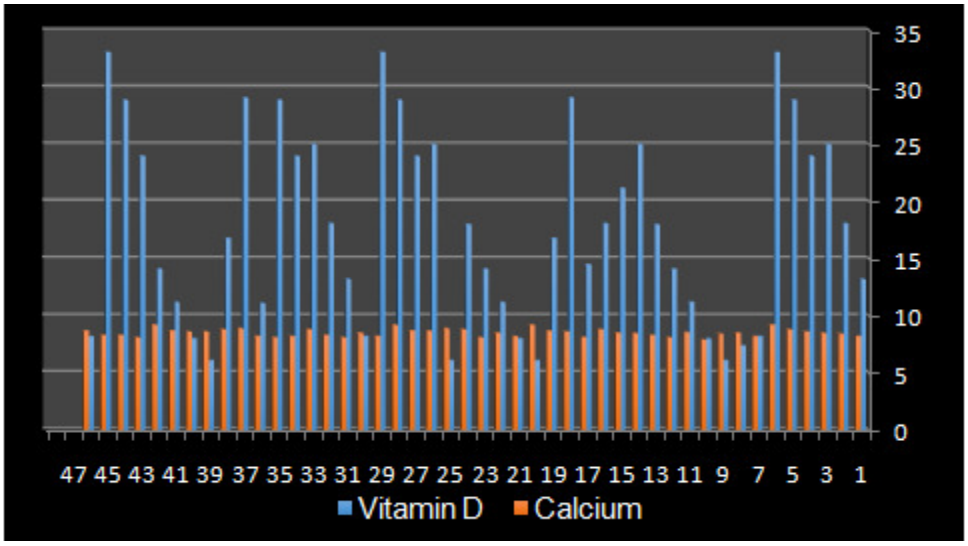

Fig. 2 : Relationships between vitamin D and calcium.

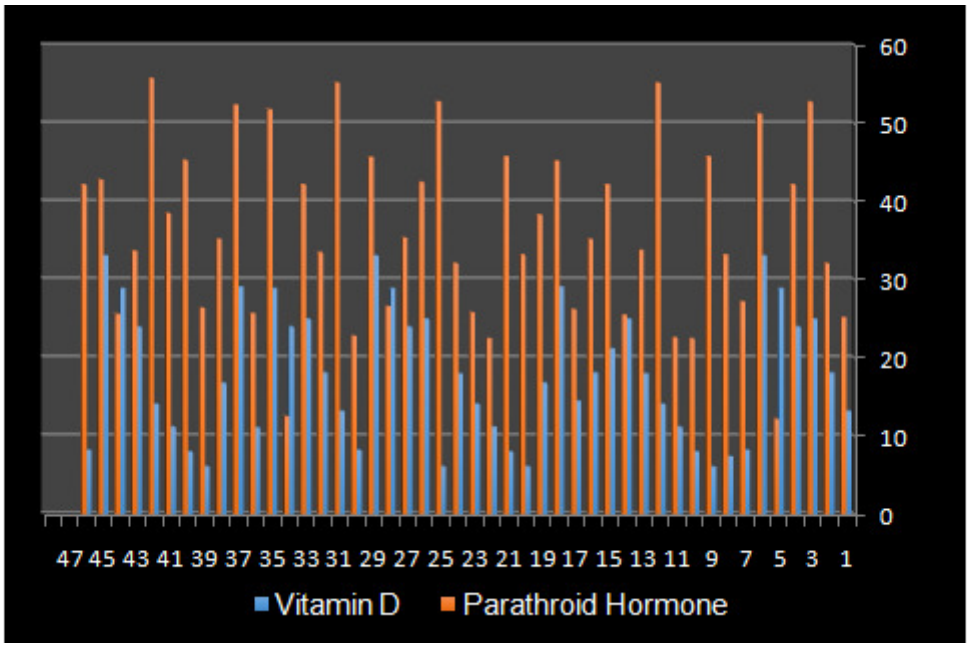

Fig. 3 : Relationships between vitamin D and Parathyroid Hormone.

vitamin D and Phosphorus Acid, as shown in Fig. 5 the value of Phosphorus acid has been remained almost constant at a decrease or increase in the value of vitamin D.

Statistical analysis

Data were represented in simple statistical number measures, minimum, percentage, maximum, mean, Std. Error of Mean and standard deviation using SPSS software version 22 analysis (statistical package for social sciences). The Pearson's correlation coefficient was used for the determination of the correlation between two quantitative data in varied groups while statistical analysis for the significance of differences of the quantitative data was done by using Student's t-test for two ANOVA and independent means test for more than two independent means. Statistically significant probability value was $p < 0.05$.

DISCUSSION

The mean age of patients suffers from vitamin D deficiency was (32.5 years) showed in Table 1. There is was no differences between men and women. The correlation ratio between vitamin D and calcium was (0.114) as showed in Table 2. This result appeared no significant differences between vitamin D and calcium as in the Fig. 2, this result was different from the study of Sahota (2000), who found a relationship between vitamin D and calcium so he used vitamin D as a therapy, also Dawson-Hughes and co-workers' studied the

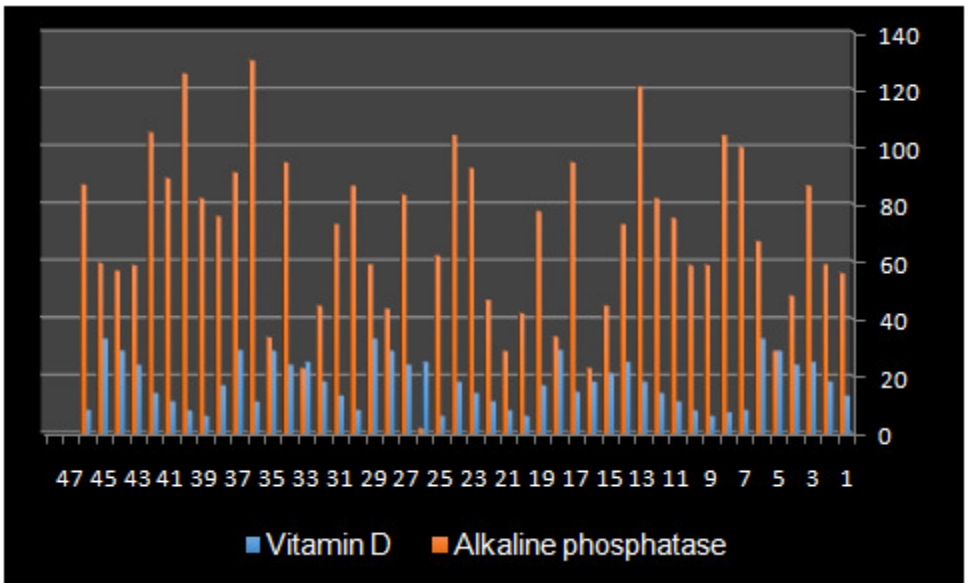

Fig. 4 : Relationships between vitamin D and Alkaline phosphatase.

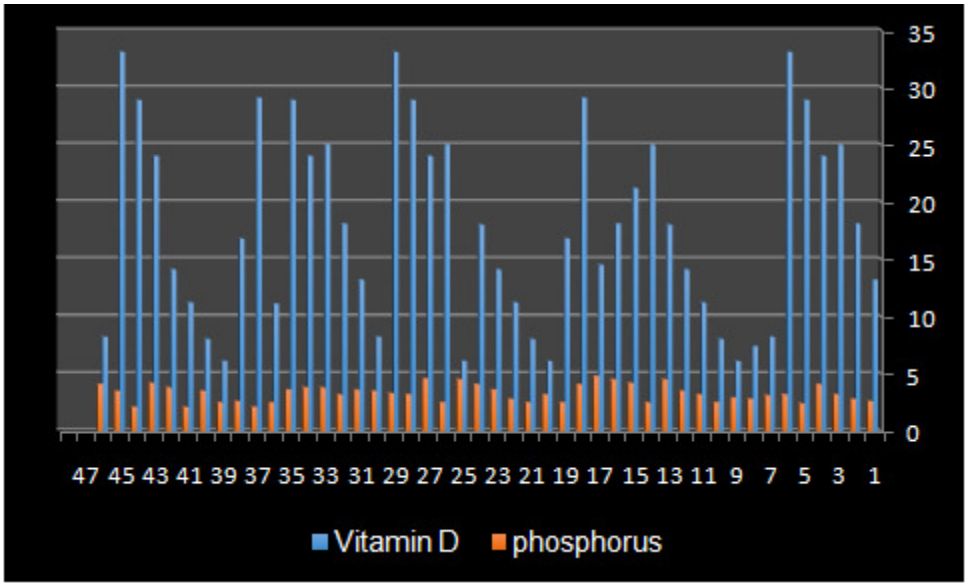

Fig. 5 : Relationships between vitamin D and phosphorus.

patients over the age of 65 years living at home showed that therapy for three years with 700 IU of vitamin D3 plus 500 mg of calcium increased the bone mineral density at both hip and spine (Dawson-Hughes, 1997), while (Chapuy *et al*, 1994) showed that supplementation with 1.2 g calcium and 800 IU vitamin D3 resulted in a 43% reduction, also when compared between calcium with parathyroid hormone the ratio of correlation was (0.192) this result refered to a simple deferent but not significant , this results differs from the previous, some studies suggested manifest of white individuals which showed several differences in calcium-related pathways compared with african american individuals that have dark skin (Gutiérrez *et al*, 2011).

The correlation ratio between vitamin D and Parathyroid Hormone was (0.128) as in Table 2. This results appear simple differences but not significant between vitamin D and Parathyroid hormone as in the Fig. 3. This result was similar to the result of Cavalier *et al* (2019), while this result differs from the result of Yalla *et al* (2019), who found inverse relationship between PTH and vitamin D levels in serum samples from apparently healthy individuals.

The correlation ratio between vitamin D and Alkaline phosphatasewas (-.374-*) as in the Table 2. This results showed significant differences between vitamin D and Alkaline phosphatase as in the Fig. 4, this result was similar to the result of Cavalier *et al* (2019), who found a strong correlation between PTH and Alkaline phosphatase levels also he found same correlation between vitamin D and

Alkaline phosphatase which is in the same time similar to the study of Kdigo (2012).

The correlation ratio between Vitamin D and Phosphorus was (0.059) as in the Table (2) this results showed no significant differences between vitamin D and Phosphorus as in the Fig. 5, this result was deferent from the results of Robert (2015), who referred to phosphorus homeostasis depended on vitamin D (2015).

REFERENCES

Cavalier E, Yayo E S, Hauhouot M L J L, Yapo C Y, Monnet D, Gnionsahe A, Souberbielle J C and Delanaye P (2019) Vitamin D, bone alkaline phosphatase and parathyroid hormone in healthy subjects and haemodialysed patients from West Africa: impact of reference ranges and parathyroid hormone generation assays on the KDIGO guidelines. *Clinical Kidney Journal* **12**(2), 288–293, 291.

Chapuy M C, Arlot M E and Delmas P D (1994) The effect of calcium and cholecalciferol treatment for three years on hip fractures in elderly women. *BMJ* **308**, 1081–1082.

Dawodu A, Agarwal M, Hossain M, Kochiyil J and Zayed R (2003) Hypovitaminosis D and vitamin D deficiency in exclusively breast-feeding infants and their mothers in summer: a justification for vitamin D supplementation of breast-feeding infants. *J Pediatr*. **142**, 169-173.

Dawson-Hughes B, Harris S S and Krall E A (1997) Effect of calcium and vitamin D supplementation on bone density in men and women 65 years of age or older. *N Engl J Med.* **337**, 670–676.

Kim E E and Wyckoff H W (1991) Reaction mechanism of alkaline phosphatase based on crystal structures. Two-metal ion catalysis. *Journal of Molecular Biology* **218**(2), 449–464.

Gutiérrez O M, Farwell W R, Kermah D and Taylor E N (2011) Racial differences in the relationship between vitamin D, bone mineral density and parathyroid hormone in the National Health and Nutrition Examination Survey. *Osteoporos Int.* **22**, 1745–1753.

KDIGO Working Group (KDIGO) (2012) Clinical practice guideline for the evaluation and management of chronic kidney disease. *Kidney Int Suppl.* **3**, 1–150.

Khundmiri S J, Murray R D and Lederer E (2016) PTH and vitamin D. *Compr Physiol.* **6**, 561–601.

Kirkby E and Pilbeam D (1984) Calcium as a plant nutrient. *Plant Cell Environ*. **7**, 397–405.

Kleist T J, Spencley A L and Luan S (2014) Comparative phylogenomics of the CBL-CIPK calcium-decoding network in the moss Physcomitrella, Arabidopsis, and other green lineages. *Front. Plant Sci*. **5**.

Kota S, Jammula S, Kota S, Meher L and Modi K (2013) Correlation of vitamin D, bone mineral density and parathyroid hormone levels in adults with low bone density. *Ind. J Orthop*. **47**(4), 402-407.

Leerbeck E and Søndergaard H (1980) The total content of vitamin D in human milk and cow's milk. *Br J Nutr*. **44**(01), 7.

Le Du M H, Stigbrand T, Taussig M J, M´enez A and Stura E A (2001) Crystal structure of alkaline phosphatase from human placenta at 1.8 ÚA resolution: implication for a substrate specificity. *The Journal of Biological Chemistry* **276**(12), 9158–9165.

McCarty D E, Reddy A, Keigley Q, Kim P Y, Cohen S and Marino A A (2013) Nonspecific pain is a marker for hypovitaminosis D in patients undergoing evaluation for sleep disorders: a pilot study. *Nature and science of sleep*. **5**, 37.

Metzger M, Houillier P and Gauci C (2013) Relation between circulating levels of 25(OH) vitamin D and parathyroid hormone in chronic kidney disease: quest for a threshold. *J Clin Endocrinol Metab.* **98**, 2922–2928 .

Parfitt A M (1987) Bone and plasma calcium homeostasis. *Bone* **8**, S1–5.

Pauly N, Knight M R, Thuleau P, van der Luit A H, Moreau M, Trewavas A J, Ranjeva R and Mazars C (2000) Cell signalling: control of free calcium in plant cell nuclei. *Nature* **405**, 754–755.

Robert J and Van S (2015) Vitamin D and phosphorus interrelationships in alpaca.

Sachan A, Gupta R, Das V, Agarwal A, Awasthi P K and Bhatia V (2005) High prevalence of vitamin D deficiency among pregnant women and their newborns in northern India. *Am J Clin Nutr*. **81**, 1060-4S.

Sahota O (2000) Osteoporosis and the role of vitamin D and calcium–vitamin D deficiency, vitamin D insufficiency and vitamin D sufficiency, 1Ageing and Disability Research Unit, B floor, Medical School, Queen's Medical Centre, University Hospital, Nottingham NG7 2UH, UK, 303.

Streym S V, Hojskov C, Moller U, Heickendorff L, Vestergaard P and Mosekilde L (2015) Vitamin D content in human breast milk: a 9-mo follow-up study. *Am J Clin Nutr*. **103**(1), 107-114.

Wagner C L, Howard C, Hulsey T C, Lawrence R A, Taylor S N and Will H (2010) Circulating 25-Hydroxyvitamin D levels in fully breastfed infants on oral vitamin D supplementation. *Int J Endocrinol*. 2010:235035.

Yalla N, Bobba G, Guo G, Stankiewicz A and Ostlund R (2019) Parathyroid hormone reference ranges in healthy individuals classified by vitamin D status. *Journal of Endocrinological Investigation*.