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Article

The role of vitamin D3 in oligospermia in Iraqi patients

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Abstract

Vitamin D is a steroid hormone 25-hydroxycholecalciferol (Vitamin D (25(OH)D; vit D), also called calciferol; it is one of the four fat-soluble vitamins (A, D, E, and K) stored in the body tissues. Vitamin D is the only vitamin that can be synthesized by the human body in the skin when exposed to sunlight, namely the ultraviolet B radiation (UVB). Other sources of vitamin D include dietary supplements and food. Vitamin D regulates hormone production and receptor expression in theca and granulosa cells of developing follicles, which affects follicle recruitment and maturation. Vitamin D alters sperm motility and metabolism and also impacts the ability of sperm to undergo the acrosome reaction and, consequently, the ability to fertilize the ovum. According to the World Health Organization, infertility is a disease of the reproductive system defined by a failure to achieve a clinical pregnancy after 12 months or more of regular unprotected sexual intercourse. Aim of the study: To study the level of vitamin D3, FSH, LH, Prolactin, Testosterone, calcium, and phosphorus in the blood of patients complaining of infertility, either due to a decrease in sperm count or a decrease in motility and viability of the sperm. The results compare with the same results of normal fertile subjects. Subject, materials and methods: The subject will include 90 patients with infertility due to oligospermia. For women, these patients will be collected from Kamal Al-Samurai Hospital and Fatima AL-Zahra. At the same time, 30 average fertile persons were compared with the patient group. Each subject of both groups has undergone the following examination- A microscopical examination of seminal fluid. Estimate the level of vitamin D3 in the blood. c- Estimate FSH, LH, PRL and Testosterone hormone levels. Estimate serum level of calcium and phosphorous. Results: The total number of study participants was 120. They were divided into two main groups: The case group included 90 patients suffering from infertility due to oligospermia, which was subdivided into mild, moderate, and severe groups, including 30 patients in each one, and the control group included 30 fertile participants. Conclusion: in this study, we found the mean ± SD vitamin D level was significantly lower in the patients compared with the control as well as Serum levels of FSH, LH, and testosterone were significantly lower in the patient group, while Serum prolactin was significantly higher in the patient group. We also found that Serum calcium was significantly lower, while serum phosphorus was significantly higher in the case group than in the controls.

Keywords: Interleukin 17A , Interleukin 18 , ELISA, Active TB, Latent TB.

Introduction

Vitamin D is one of the fat-soluble secosteroids responsible for enhancing intestinal absorption of calcium and phosphate. Besides, it has many other biological effects: [1]. In humans, Vitamin D is presented mainly as Vitamin D3 (cholecalciferol) and vitamin D2 (ergocalciferol) [2]. The production of cholecalciferol is the leading natural vitamin source in the lower layers of skin, the epidermis, through a chemical reaction when exposed to sunlight, ultraviolet B, and UVB radiation 3. Vitamin D from the diet or skin synthesis is biologically inactive. It is activated by hydroxylation by two protein enzyme steps, the first in the liver and the second in the kidneys.[4] As vitamin D can be synthesized in adequate amounts by most mammals exposed to sufficient sunlight, there is no need for vitamin D supplement [2].

Infertility is a disease of the male or female reproductive system described as the failure to achieve a pregnancy after 12 months or more of regular unprotected sexual intercourse [5]. Between 48 million couples and 186 million individuals have infertility globally [6], male infertility accounts for 40% of that number [7].

Materials and Methods

The subject will include 90 patients who have infertility due to oligospermia, mild(10-15) million /ml(n=30), moderate(5-10) million / ml (n=30), severe (1-5) million / ml (n=30). These patients will be collected from Kamal Al-samarrai Hospital and Fatima Al-zahraa for women. At the same time, 30 average fertile persons were compared with the patient group. A randomized clinical trial study was conducted on 90 males infertility of age range (18 - 45) years. Basal blood sample was taken from each patient to assess serum levels of 25 [OH] D, FSH, LH, prolactin, testosterone and assessment of Calcium with Phosphorous as well as seminal fluid analysis; the semen samples were collected from all patients in a clean, sterile cup and put in an incubator for 15-20 minute in order to make the liquefaction of semen with abstinence time (3-4) days and then checking by light microscope that was used to exam semen samples.

Results

The total number of study participants was 120. The case group included 90 patients who have infertility due to oligospermia. The control group included 30 healthy, fertile participants. Study participants' age ranged from (18 – 45) years, with a mean of 30.16 years and a standard deviation (SD) of 6.7 years. The highest proportion of study participants in case and control groups was aged < 30 years (51.1% and 60% respectively). The mean BMI level was significantly higher in the case group than in the control group. However, there was no significant difference between the two groups in age (P= 0.061) and body mass index (BMI), as shown in the Table below.

Variable	Study Groups: Case Mean ± SD	Study Groups: Control Mean ± SD	P - Value
Age (Years)	30.74 ± 6.5	28.62 ± 6.0	0.061
BMI (kg/m²)	23.28 ± 1.7	22.43 ± 1.8	0.03

Table 1: BMI level.

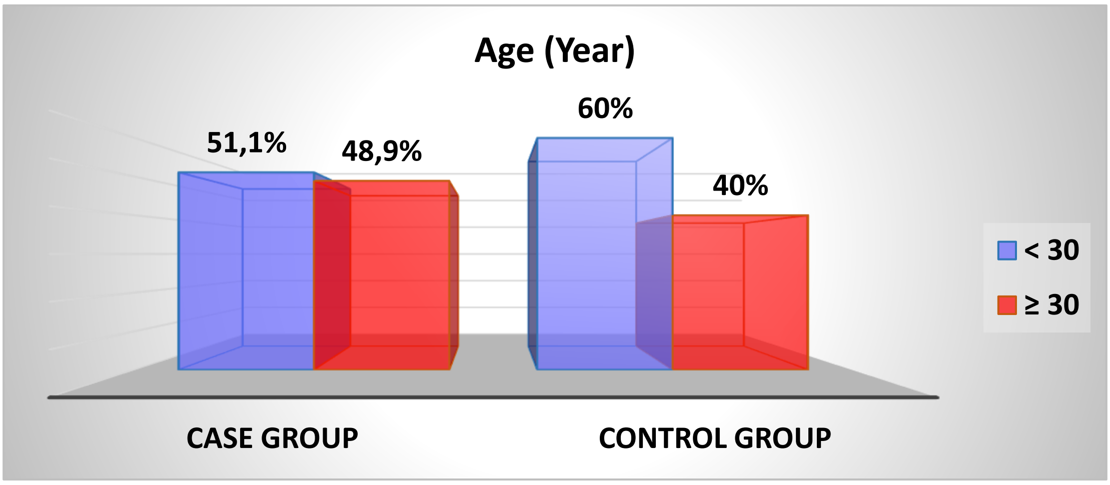

Figure 1: Distribution of study groups by age.

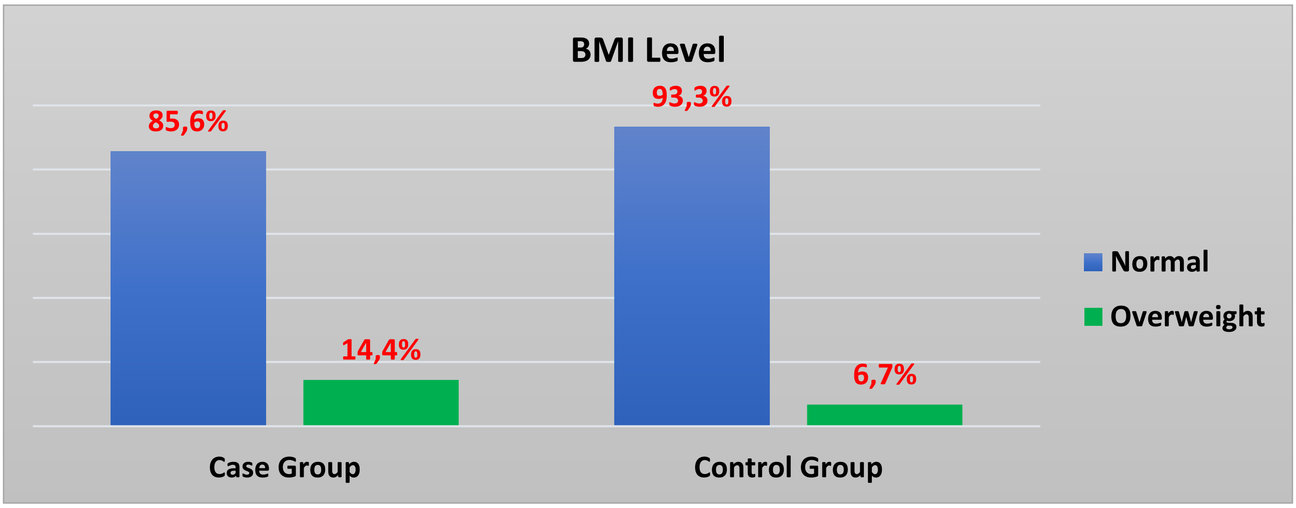

Figure 2: Distribution of study groups by BMI level.

The result of the present study showed significant moderate positive correlations were detected between vitamin D and all sperm count (r= 0.621, P= 0.001), FSH (r= 0.518, P= 0.001), and LH (r= 0.581, P= 0.001). In contrast, significant weak positive correlations were detected between vitamin D and all of the testosterone (r= 0.308, P= 0.003), S. Ca (r= 0.23, P= 0.029), and S. Ph (r= 0.368, P= 0.001). A significant moderate negative correlation was seen between vitamin D and prolactin (r= - 0.533, P= 0.001). A significant negative correlation was found between vitamin D and immotile sperm (r= - 0.714, P= 0.001). No statistically significant correlations were detected between vitamin D and all age, BMI, infertility duration, and volume of seminal fluid, as shown in table (2).

Variable	Vitamin D (ng/ml)	
	R	P - Value
Age (Year)	- 0.139	0.19
BMI (kg/m^2)	0.06	0.577
Infertility Duration (Year)	- 0.129	0.225
Volume of seminal fluid (ml)	0.062	0.562
Sperm count (/million)	0.621	0.001
Immotile Sperm (%)	- 0.714	0.001
FSH (mIU/ml)	0.518	0.001
LH (IU/L)	0.581	0.001
Prolactin (ng/ml)	- 0.533	0.001
Testosterone (nmol/L)	0.308	0.003
S. Calcium (mg/dl)	0.23	0.029
S. Phosphorus (mg/dl)	0.368	0.001

Table 2: Correlation between vitamin D level and specific parameters.

Hormonal parameters	Severity of oligospermia			P - Value
	Severe Mean ± SD	Moderate Mean ± SD	Mild Mean ± SD	
FSH (mIU/ml)	3.45 ± 0.3	3.57 ± 0.3	4.52 ± 0.6	0.001
LH (IU/L)	1.35 ± 0.5	2.55 ± 0.3	3.13 ± 0.4	0.001
Prolactin (ng/ml)	22.39 ± 2.4	19.49 ± 3.4	16.79 ± 2.5	0.001
Testosterone (nmol/L)	3.12 ± 0.5	3.87 ± 1.0	4.56 ± 0.8	0.001

Table 3: Comparison in hormonal parameters according to severity of oligospermia.

Biochemical parameters	Study Groups		P - Value
	Case Mean ± SD	Control Mean ± SD	
Vitamin D (ng/mL)	16.39 ± 4.9	33.93 ± 6.4	0.001
S. Calcium (mg/dl)	8.02 ± 1.2	9.98 ± 0.4	0.001
S. Phosphorus (mg/dl)	2.35 ± 0.8	1.08 ± 0.15	0.001

Table 4: Comparison between study groups according to biochemical parameters.

Biochemical parameters	Cut-off value	Sensitivity	Specificity	PPV	NPV	Accuracy
Vitamin D (ng/mL)	24.69	92.2%	96.7%	98.8%	80.6%	93.3%
S. Calcium (mg/dl)	9.19	88.9%	96.7%	98.8%	74.4%	90.8%
S. Phosphorus (mg/dl)	1.53	84.4%	100%	100%	68.2%	88.3%

Table 5: Diagnostic accuracy of biochemical parameters as predictive markers for oligospermia.

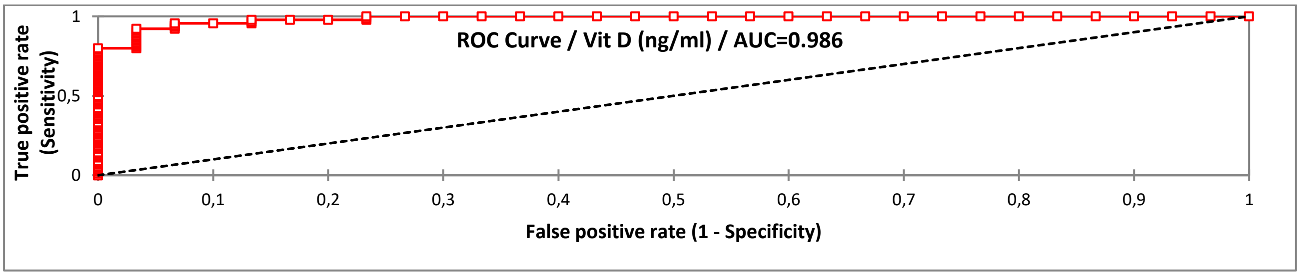

Figure 3: ROC curve for vitamin D in predicting oligospermia.

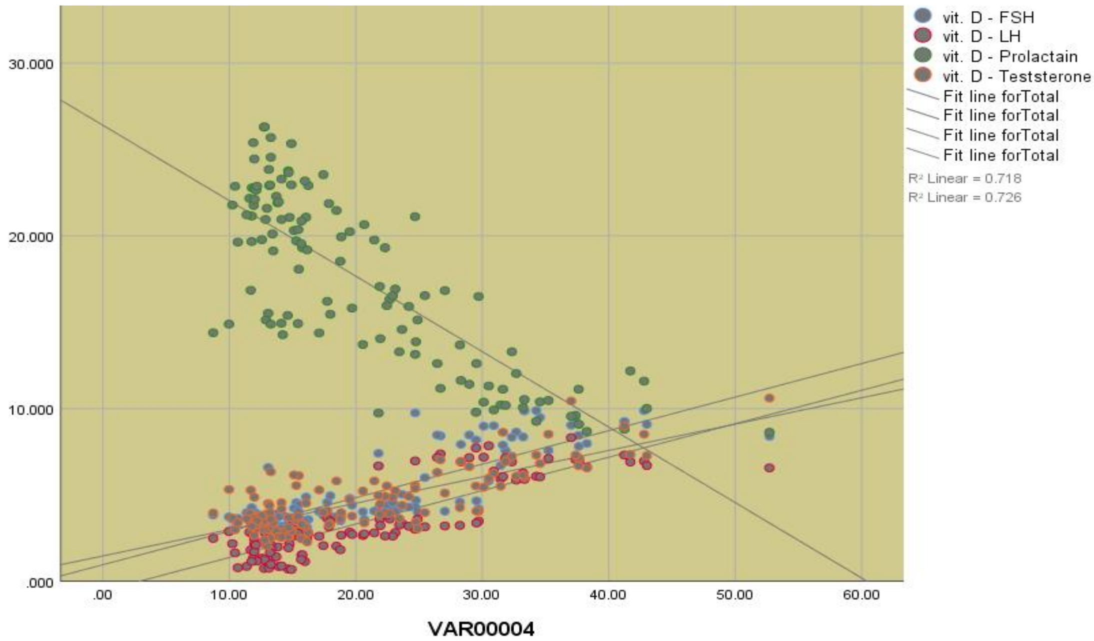

Figure 4: Scattered dot diagram involving the correlation between vitamin D with FSH, LH, prolactin and testosterone.

Discussion

Vit D's significance in the pathophysiology of infertility and poor sperm quality has recently been investigated in several types of research. These have shed light on the association between vitamin D, male infertility, and related mechanisms [8,9,10,11]. Vitamin D was previously linked to calcium/phosphate balance, cardiovascular and bone health, the immunological system, and cancer [12]. Since 1979, a growing data collection shows that vitamin D affects male fertility. Vitamin D receptor (VDR) is prevalent in the reproductive system, including spermatozoa, and could be used to exert vitamin D physiological effects [13,14]. The most essential hormones that are involved in male infertility are FSH, LH, testosterone, and gonadotropin. These hormones regulate spermatogenesis, and the reduction of these hormones can lead to infertility [15]. In the present study, we found a significantly lower vitamin D level in infertile males compared to the fertile group. In this research, the results agree with the study of [khan et al.], who showed significant moderate positive correlations between vitamin D and all sperm count (r= 0.621, P= 0.001), FSH (r= 0.518, P= 0.001), and LH (r= 0.581, P= 0.001);. In contrast, significant positive correlations were detected between vitamin D and all of the testosterone (r= 0.308, P= 0.003), S. Ca (r= 0.23, P= 0.029), and S. Ph (r= 0.368, P= 0.001). The levels of vitamin D, sex hormones, and phosphorous in research approximate the values of these variables in our research [17]. At the same time, in other studies, no relationship was observed between vitamin D and sex hormones. This study disagreed with the result of our study[Blomberg Jensen]. The present study elicited a significant moderate negative correlation between vitamin D and prolactin (r= - 0.533, P= 0.001). No statistically significant correlations were detected between vitamin D and all ages, BMI, infertility duration, and volume of seminal fluid, as shown in Table (4.10). These results agree with those of the previous studies [Kaddam et al.]. In addition, we noticed that the means of FSH, LH, and testosterone levels were significantly lower in the case group, when the mean was (3.85±0.6),(2.34±0.8),(3.85±1.0) respectively. In contrast, the mean of prolactin was significantly higher ($P < 0.05$) in the case group than in the controls.

Conclusion

In this study, we found that mean ± SD vitamin D levels were significantly lower compared with the control and Serum levels of follicle-stimulating hormone, Luteinizing hormone, and testosterone revealed significantly lower levels in the case group. At the same time, Serum prolactin was significantly higher in the case group. We also found that Serum calcium was significantly lower, while serum phosphorus was significantly higher in the case group than in the controls. The sperm count, morphology, and motility are significantly decreased in the patient group compared with the control group.

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