Correlation Between Serum 25-hydroxyvitamin D Content and Testosterone Content in Young Healthy Males: A Single Center Cross-Sectional Study

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Significance: In current scenario of sedentary lifestyle there are two major challenges: One is low levels of vitamin D and low levels of testosterone. Both factors affecting overall male health. There is need to identify relationship of both factors. Results of the study will help healthcare providers to treat the accordingly.

Abstract

Objectives: The current study is conducted to compare serum 25-hydroxyvitamin D concentrations and total testosterone in young, physically fit adult males.

Study Design: the study was based on cross sectional design.

Study Settings: The research was conducted in Department of Pathology, Shahida Islam Medical and Dental College situated in District Lodhran between 1st July, 2023 and December, 2023.

Methods: This cross-sectional research, which took place at the Department of Pathology at Shahida Islam Medical and Dental College in Lodhran from July 1, 2023, to December 31, 2023, had 176 young male volunteers, all between the ages of 18 and 35. Each participant was given questionnaires to fill out on their prior medical history, food habits, and rigorous exercise levels. Every participant had their blood drawn following a 12-hour fast and a 24-hour period without physical exercise. Separating serum was done with a centrifuge. The blood concentration of LH, FSH, total testosterone, and 25-hydroxyvitamin D were measured by electrochemiluminescence (ECLIA).

Results: A total of 176 individuals in good health were registered, with a mean age of 26.62±5.20 years. The presence of vitamin D of less than 10 ng/ml, between 10–20 ng/ml, and greater than 20 ng/ml were reported in 70 (39.8%), 76 (43.2%), and 30 (17.0%) individuals, accordingly. The mean hormone levels (TT, FSH, and LH) in the three 25(OH)D groups did not vary statistically. Our findings showed that there existed no statistically substantial relationship in the categories under study between 25(OH)D and LH, FSH, and TT.

Conclusion: We found little variation in the condition of the 25(OH)D concentration and the average hormonal measurements (LH, FSH, and TT). Based on these data, we concluded that in young, healthy guys, there is no relationship between testosterone concentrations and deficient or inadequate 25(OH)D level.

Introduction:

Over the past few decades, numerous assessments of the vitamin D level of the world's population have been published. While some nations may consider their 25(OH)D) concentrations to indicate a good level of vitamin D sufficiency, vitamin D deficiency remains widespread globally and across different risk categories (1). It is among the most ancient biologically active compounds due to its involvement in fundamental physiological processes (2). Its evolution is closely tied to the ability of organisms to harness sunlight for the synthesis of this important molecule, and it has been conserved and adapted in various ways throughout the history of life on Earth (3). Studies into Vitamin D's effects on non-traditional target organs and tissues have been prompted by the realization that it is a pleiotropic signaling molecule (4,5). The hypothesis that Vitamin D3 (VD3) may be a powerful player in male reproductive function is supported by the detection of the Vitamin D3 receptor (VDR) in spermatogonia, spermatids, spermatozoa, Leydig, Sertoli, and developing germ cells (6). It is still unclear, nevertheless, how low serum testosterone levels relate to vitamin D insufficiency (7). Researches on both fertile and infertile men have revealed evidence that a vitamin D deficit may affect the fertility of men (8-10). While an investigation on Filipino males found no significant association between 25OHD and sex hormones, it was observed that there was an upward trend between the levels of free testosterone (FT) and total testosterone (TT) among Korean men (11,12). The results are constrained, nevertheless, by the size of the cohort and the distinction between ethnicity and racial background.

This led us to assess the correlation between testosterone levels and serum 25OHD in young, healthy male patients visiting our hospital. In spite of sufficient sunshine and past Food Acts mandating vitamin D fortification of food, research carried out on Pakistani nationals in many cities revealed significant levels of inadequacy across all age categories, genders, economic brackets, and geographic areas. 53.5% of the population had low vitamin D, 31.2% had inadequate vitamin D, and just 15.3% had appropriate vitamin D (13). The current study is carried out in this context if Vitamin D levels would correlate with the male sex hormone, in our population, then further studies can be carried out to see the causal relationship by supplementing Vitamin D.

Objective

To correlate the serum Vitamin D and testosterone levels in young and physically fit males.

Methods

Design and Study setting: This was a cross-sectional study was conducted in the Department of Pathology, Shahida Islam Medical and Dental College situated in District Lodhran.

Duration of the study: Duration of the study was from 1st July 2023 to 31st December 2023.

Sampling Technique: Non-probability purposive sampling was used for the recruitment of patients.

Inclusion Criteria:

- Age 17-35 years.
- Healthy Male

Exclusion Criteria:

- Infertile male
- Serious testicular dysfunction
- Previous bilateral vasectomy
- Clinical urogenital infection or surgery
- Previous cancer treatment (Chemo-radiation therapy)
- Being out of age-range criteria
- Chronic diseases.
- Individuals on prescribed drugs that might conflict with a hormone evaluation.

Methods:

This research was a cross sectional study, being carried out in Department of Pathology, Shahida Islam Medical and Dental College, Lodhran, after the approval of Ethical Committee of the respective Hospital, in the time frame of 10 months. A total of 176 young healthy males were enrolled. A conversant permission was obtained from all the participants, which was duly signed by the researcher and participant/guardian. Every individual who was enrolled had a thorough clinical evaluation. After enrollment all patients were instructed to complete questionnaires about their medical histories, dietary practices (including a recall diary for the previous seven days), and physical doings (including the IPAQ and last seven-day recall). Energy expenditure was used to describe activity intensity, and metabolic equivalents (METs) were used to represent this definition: For every kilogram of body weight, one MET is equivalent to 3.5 milliliters of oxygen per minute.

Sample of 8 ml blood was taken from every participant were taken from all the participants after fasting for 12 hours and no physical activity in last 24 hours, by a trained phlebotomist. Serum was separated by using centrifuge machine. Electrochemiluminescence method (ECLIA) was used to measure the serum levels of 25-Hydroxyvitamin D, LH, FSH, and Total Testosterone (TT). For statistical analysis SPSS Version 24 were used. This led us to assess the correlation between testosterone levels and serum 25OHD in young, in good health male patients visiting our hospital. In spite of sufficient sunshine and past Food Acts mandating vitamin D fortification of food, a research carried out on Pakistani nationals in many cities revealed significant levels of inadequacy across all age categories, genders, economic brackets, and geographic areas. 53.5% of the population had low vitamin D, 31.2% had inadequate vitamin D, and just 15.3% had appropriate vitamin D.

Results:

A total of 176 healthy participants with mean age of 26.62±5.20 years were enrolled (Table 1). We identified 70 (39.8%), 76 (43.2%), and 30 (17.0%) participants with vitamin D levels ≤10 ng/ml, between 10–20 ng/ml, and ≥20 ng/ml, respectively. The 25(OH) D level ranged from 10 to 20 ng/ml in 44% of the subjects (n = 77), and 40% of them (n = 70) had an amount under 10 ng/ml, that is considered a vitamin D deficit (14).

Table 1: Characteristics of enrolled patients *(n=176)*

Variables	Value
Age (Years)	26.62±5.20
25(OH)D:<10 ng/ml	70 (39.8%)
25(OH)D:10-20 ng/ml	76 (43.2%)
25(OH)D:>20 ng/ml	30 (17.0%)

Baseline characteristic of the enrolled patients on the basis of 25(OH) D was given in Table 2

Table 2: Baseline characteristics of the enrolled patients on the basis of 25(OH) D *(n=176)*

	25(OH)D ng/ml		
	<10 *(n=70)*	**10-20 *(n=76)***	**>20 *(n=30)***
Age (Years)	26.21±4.80	27.06±4.71	29.00±4.58
BMI (kg/m2)	23.71±2.29	24.35±2.64	23.03±2.41
Waist–hip ratio (WHR)	0.90±.15	0.87±0.10	0.93±0.13
Current smoker	16 (22.9%)	11(14.5%)	3(10.0%)
MET-total [MET-min/week]	4790.70±210.5	5330.7±32.3	6761.5±516.7

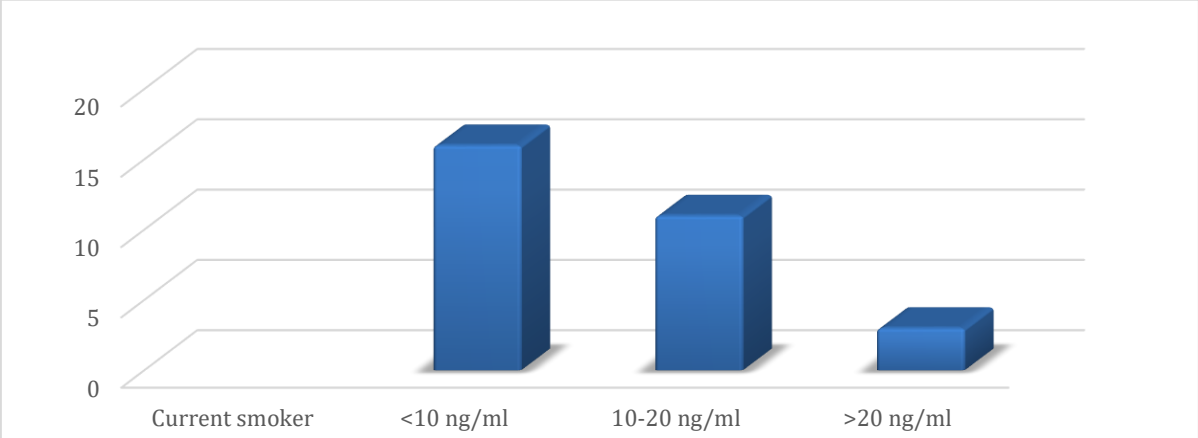

Figure 1: Bar graph showing distribution of patients on the basis of current smoker.

Table 3 shows the differences between groups categorized according to 25(OH)D levels) in terms of hormonal parameters. No statistical difference was found between the mean hormonal values (LH, FSH, and TT) in three categories.

Table 3: Adjusted mean (s.e.) of hormonal parameters per status of serum vitamin D level *(n=176)*

	25(OH)D ng/ml			
	<10 (n=70)	**10-20 (n=76)**	**>20 (n=30)**	**P-Value**
LH (mIU/ml)	5.33±0.87	4.77±0.86	5.07±0.93	0.64
FSH (mIU/ml)	4.60±1.2	4.10±1.3	5.12±0.9	0.80
TT (nmol/l)	5.64±0.83	6.06±0.85	6.16±0.70	0.99

Table 4 displays the partial relationship and Pearson coefficient values after age, BMI, tobacco use, and alcohol use have been taken into account. According to our findings, there is no substantial relationship between the study population's 25(OH)D and LH, FSH, and TT.

Table 4: Correlation of 25(OH)D with LH, FSH and TT *(n=176)*

Variable	R Value	P Value
LH (mIU/ml)	-0.166	0.02
FSH (mIU/ml)	0.061	0.42
TT (nmol/l)	0.248	0.00

Discussion

Intensive investigations on the actions of Vitamin D on its non-classical target organs and tissues are being carried out due to a global debate on Vitamin D deficiency in the general population (15). The reproductive organs of males are among the tissues that vitamin D targets, and it was additionally identified as an overall signaling molecule (16).

In this cross-sectional study, correlating the serum levels of testosterone and vitamin D in young, healthy male Pakistanis was the primary goal. We have interviewed a large number of people but only 176 fulfilled the selection criteria.

Anna Książek et al. corroborated our findings, concluding that there is no correlation between androgen concentrations in young, males in good health and inadequate or insufficient 25(OH)D level (17). Rudnicka, A. et al.'s investigation on young Spanish males produced similar findings, demonstrating no correlation between vitamin D quantities and levels of LH, FSH, TT, inhibin B, or estradiol (18). In contrast, a research by Lerchbaum et al. on middle-aged males found that total testosterone content were not significantly affected by even a considerable boost in blood vitamin D content (19).

In contrast, Tak et al.'s results in a population of 652 Korean males showed a statistically substantial correlation between the levels of total and free testosterone and 25(OH)D (11). Additionally, Rafiq et al. studied the correlation between testosterone and SHBG fractions and vitamin D amounts in a cohort of 459 men (20). Despite the fact that these men belonged to an older age category, there was a statistically substantial positive connection between the levels of total and bioavailable testosterone and 25(OH)D.

An MR study by Chen et al. on a cohort of 4254 Chinese men in order to investigate the possible causative link between testosterone levels and vitamin D insufficiency (21). According to their investigation, testosterone levels were linked to a hereditary drop in 25-hydroxyvitamin D (25(OH)D), which may indicate that vitamin D has a causative role in raising testosterone levels.

The relationship between semen quality, physical activity, and vitamin D concentration has also been investigated in various studies (22-24). In a study by Pliz et al. they found that a cohort of 31 middle-aged males (average age 49.2 ± 10.2 years) who received vitamin D supplementation had higher levels of total testosterone (25). The authors clarified this and said that more study is necessary to support the hypothesis that vitamin D administration can raise testosterone levels. Little research studies were available that elucidate the mechanism underlying vitamin D's possible effects on increasing or decreasing

testosterone synthesis. The theories that extragenic vitamin D aromatase activity, osteocalcin, or Leydig cell calcium homeostasis are the origins of serum testosterone levels require preliminary investigation to validate (9,26-27). Any straightforward and affordable medical treatment approach to enhance testicular function, like vitamin D supplementation, needs to be promoted due to its affordability, ease of use, and potent biological effects, especially in light of the escalating concerns surrounding the extensive and unregulated use of aided reproductive technological advances (28).

Limitations

There are many restrictions on our investigation. First of all, our results may not fully represent the broader community since we chose a small research sample of men who were patients at our hospital. Second, the total of free, albumin-bound, and SHBG-bound testosterone is known as total testosterone. A few different factors can readily alter the blood level of SHBG, making TT readings deceptive in some situations. Furthermore, we did not look into the significance of serum PTH, which is a key factor in determining vitamin D status. To fully understand this link in our communal contexts, more thorough research is needed.

Conclusion: Our research shows that there is no correlation between testosterone amounts and 25(OH)D levels in a sample of healthy, youthful, vigorously active males visiting our hospital. It should be mentioned that our research does not rule out the potential that testosterone levels might be impacted by following the recommended procedure for vitamin D administration. Consequently, more investigation is required to confirm how vitamin D supplementation affects androgen concentrations in youthful, healthy males.

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