Effectiveness of vitamin D3 in improving sperm count, motility and morphology in subfertile men

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ABSTRACT

The effect of vitamin D3 in improving sperm count, motility and morphology of subfertile men was assessed using pretest-posttest design. All men who attended OPD at a selected hospital were screened with Male Fertility Profile. Forty-six subfertile men among them were diagnosed as oligoasthenoteratozoospermia were chosen as study participants. A detailed explanation of the study was given to the selected participants, and the written consent was received from each study participant. They were given treatment under the guidance of our fertility experts, the oral administration of vitamin D3 supplements per oral twice a day for 72 days and the post-test semen analysis was done on 73rd day. The findings of the study revealed that there is an improvement in the semen quality (counts in the sperm million/ml, progressive motility level, total progressive motility level P<0.00001 and morphology P <0.00007). In contrast, there were no changes revealed in the level of volume, and PH was slightly alkaline. Vitamin D enhances spermatogenesis. Therefore, vitamin D supplements can be administered in oligoasthenoteratozoospermia men.

INTRODUCTION

Infertility is a significant issue affecting the individuals of all communities worldwide. According to the International Committee For Monitoring Artificial Reproductive Technology (ICMART) and World Health Organization (WHO), infertility means inability in conceiving after one year or more than a year of unprotected intercourse (Zegers-Hochschild et al., 2009). While infertility is considered a medical condition, the inability to conceive is considered as the couple’s problematic issue. In the majority of the cases, one-third of the root cause for infertility is with women, one third with men, one third due to interrelation between both and 20% of the reasons are unknown. Social, as well as environmental causes, play a significant role in the recent spurt in the infertility cases. (Cooper et al., 2010). Male infertility alludes to the lack of a man’s ability in causing conception infertile women. "Male-factor" infertility is considered as changes identified in the level of sperm concentration and/or motility and/or morphology in a minimum of single or two sperm specimens, obtained within a week and four
weeks later (Butt and Akram, 2013). 50% of infertility in human beings is due to this male factor, and 7% of the males are affected due to this. The cause for infertility in men is mainly due to poor quality of semen which is used as an alternate method of assessing male fertility.

According to WHO, men are considered to have male factor infertility if their sperm parameters are less than the standard WHO values (Belaisch-Allart et al., 2002). The most critical parameters are decreased concentration of sperm called oligospermia, reduced sperm movement called asthenospermia and anomalous structural changes in the sperm known as teratozoospermia (Jensen, 2014). The other factors attributed to infertility are the volume of semen and other seminal markers that are identified in the functioning of the epididymal, prostatic and seminal vesicles. (Harris et al., 2011). Nearly 90% of the infertility problems in men is due to issues in the sperm count, with studies showing a direct correlation between the aberrant parameters of semen and sperm count. (WHO, 1999). The root cause for the strange alterations in the structure, movement and count of the sperm is due to disruption in the regulatory mechanism of factors which are of pre-testicular, testicular and post-testicular origin. (Magnusdottir et al., 2005)

Vitamin D is commonly called as “sunshine hormone”. It plays an essential role in regulating the metabolism of calcium and phosphorus, thereby resulting in strong bones and teeth. It also helps the body to defend against cardiovascular diseases, obesity, cancer, diabetes and other sicknesses. (Iwamoto et al., 2007).

Vitamin D is a prohormone produced by the skin when bare skin is exposed to sunlight as Vitamin D3 or cholecalciferol. Diminished exposure to sunlight, malabsorption syndromes and drugs such as phenobarbital and rifampicin, which enhances liver enzymes P450 to initiate vitamin D catabolism results in vitamin D deficiency (Unisa, 1999).

Infertility has affected more than fifty-three million people across the world, and vitamin D deficiency is considered one of the most probable cause. Vitamin D is essential for the normal functioning of the male reproductive system. The receptor for vitamin D and the enzymes that metabolise vitamin D occur in testis, male reproductive tract and sperm. The quality of the semen is determined by the expression of the vitamin D receptor in the sperms. This observation reveals an enhanced calcium level inside the cell, thereby promoting the motility of the sperms. Vitamin D increases the phosphorylation of proteins, cholesterol outflow and improves the longevity of the sperm.

It has been identified that many infertility couples undergo various Artificial Reproductive Techniques to have a child. The majority of subfertility in men is due to the variations revealed in the sperm analysis report (mainly with decreased sperm count, decreased motility level, sperm with abnormal shape and size). Vitamin D3 is found to play a useful role in improving the spermatogenesis. Therefore the objective was to assess the effectiveness of vitamin D3 in enhancing sperm count, motility and morphology of subfertile men.

**MATERIALS AND METHODS**

The study was conducted at a selected hospital in Chennai. One group pretest post-test research design was used for the present study.

**Inclusion criteria**

Men with low motility, morphology and sperm count (oligoasthenoteroatozoospermia – decreased level of sperm count <15 million -oligospermia, poor movement of the sperm motility <32%,- asthenospermia, sperm with abnormal size and shape morphology <4% -teratozoospermia) with Thyroid Stimulating Hormone and HBA1c normal levels(normal TSH 0.25-5uIU/ml, normal HBA1c- 4-6 %) with normal gonadotropic Luteinising Hormone and Follicle Stimulating Hormone normal levels (average Luteinising Hormone level 1.1- 7.0 Miu/ml, average Follicle Stimulating Hormone level 1.7-12.0 Miu/ml) who are attending the OPD in the first set for the treatment and are willing to participate in the study.

**Exclusion criteria**

Men with azoospermia and aspermia who are having the current habit of smoking and alcohol and with history of grade III or more varicocele, testicular malignancy, men who are using antacids, antihypertensives, antipsychotics, antidepressants, antiepileptics and anticoagulants.

**Ethical Approval**

All collected data were examined and approved by the appropriate Institutional Ethics Committee (Ethical Code: 007/04/2019/IEC/SMCH) and have therefore been performed following the ethical standards laid down in the Updated Revised Declaration of Helsinki (2008).

**Data Collection Procedure**

The study was conducted after obtaining Institutional Ethical Clearance from Saveetha Medical College And Hospital. All men who attended OPD at the
Table 1: Sperm parameters before and after vitamin D supplementation

| Characteristic     | Pretest (Mean±SD) | Posttest (Mean±SD) | Standard Error | Confidence Interval | T Static | P-Value |
|-------------------|-------------------|--------------------|----------------|---------------------|----------|---------|
| Volume            | 2.23±1.05         | 2.16±0.76          | 0.190          | -0.4438-0.3118      | -0.347   | 0.7293  |
| Ph                | 7.81±0.24         | 7.89±0.21          | 0.047          | -0.0068-0.1788      | 1.841    | 0.0689  |
| Liquefaction      | 29.27±5.69        | 29.02±1.98         | 0.888          | -2.0120-1.5181      | -0.278   | 0.7816  |
| Sperm Count       | 7.41±4.89         | 44.76±20.16        | 3.059          | 31.268-43.4218      | 12.209   | <0.0001 |
| Progressive Motility | 10.00±5.90      | 24.15±9.026        | 2.397          | 9.3895-18.9145      | 5.903    | <0.0001 |
| Total Progressive Motility | 16.05±7.47 | 29.78±15.15        | 2.491          | 8.7851-18.6813      | 5.514    | <0.0001 |
| Normal Morphology | 0.95±0.73         | 1.46±0.65          | 0.144          | 0.2189-0.7917       | 3.505    | 0.0007  |

selected hospital were screened with Male Fertility Profile. Among 46 subfertile men, those who were diagnosed with oligoasthenoteratozoospermia and who met the inclusion criteria were selected as study participants.

The study technique used was the consecutive and enumerative sampling technique. After selecting the study participant, a detailed explanation about the study was given, and the written consent was obtained from all the study participants. Then, demographic data were collected from each study participant. Then the study participants were given treatment under the guidance of our fertility experts, i.e.) the clients were given the oral administration of vitamin D3 supplements (Tab. Cholecalciferol 2000 IU) per oral twice a day for 72 days, and the post-test semen analysis was done on 73rd day. Tablet compliance was checked by counting tablets on random days, and the data was stored in a password-protected computer. The agreement was observed by sending daily SMS messages and reinforced by telephonic calls.

**Statistical Analysis**

Descriptive and inferential statistics were used to analyse the data. Comparisons were performed using paired ‘t’ test; Differences were considered to be significant at p<0.05.

**RESULTS AND DISCUSSION**

The findings of the study were expressed as mean ± SD with SE, ‘t’ and P-value as depicted in Table 1. In volume, the mean ± SD in pretest was 2.23±1.05 and in post-test 2.16±0.76 with SE 0.190 ‘t’-0.347, P value 0.7293, CI (-0.4438-0.3118). In PH, the mean ± SD in pre-test was 7.81±0.24 and post-test 7.89 ± 0.21 with SE 0.047 ‘t’ 1.841, P-value 0.0689, CI (-0.0068-0.1788). In liquefaction, the mean ± SD in pretest was 29.27±5.69 and in post-test 29.02±1.98 with SE 0.888 ‘t’-0.278, P value 0.7816, CI (2.0120-1.5181). In sperm count million/ml, the mean±SD in pretest was 7.41±4.89 and in post-test 44.76±20.16 with SE 3.059 ‘t’ 12.209, P <0.0001 CI (31.268-43.4218).

In progressive motility, the mean ± SD in pretest was 10.00±5.90 and in post-test 24.15±9.026 with SE 2.397 ‘t’5.903, P <0.0001, CI (9.3895-18.9145). In total progressive motility, the mean ± SD in pretest was 16.05±7.47 and in post-test 29.78±15.15 with SE 2.491 ‘t’ 5.514, P<0.0001, CI (8.7851-18.6813). In normal morphology, the mean ± SD in pretest was 0.95±0.73 and in post-test 1.46±0.65 with SD 0.144, ‘t’3.505, P 0.0007, CI (0.2189-0.7917).

Our study demonstrated that there is the effectiveness of vitamin D3 in improving men sperm count, motility, total progressive motility and morphology. The main finding of this work was when administered oral vitamin D3 supplements there is a significant improvement in sperm count, motility, total progressive motility and morphology. According to the study of Jensen (2014), the levels of calcium in the serum is essential for the formation as well as the movement of the sperm and changes taking place in
the acrosome. Vitamin D plays a vital role in regulating the levels of calcium and phosphate in our body. Thus, it can be assumed that vitamin D plays a double role in reproduction by regulating calcium, phosphate level and influencing the production of sex hormones. This result is in agreement with our study findings wherein a significant improvement in the semen quality was observed after the administration of vitamin D supplements.

CONCLUSION

After administration of oral vitamin D3 supplements in subfertile men for 72 days, there is an improvement in the count of sperm, motility of sperm and in progressive motility, while no changes were observed in the volume and pH is slightly alkaline. Therefore, administration of vitamin D3 as a successful intervention for the subfertile men to enhance the sperm count, motility and morphology since it’s a simple and economical intervention which can be implemented as lifestyle modification.

Conflict of Interest

Authors declare no conflict of Interest.

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