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Vitamin D Deficiency in Infertile Males with Oligospermia: A Cross-sectional Comparative Study

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Abstract

Introduction: ***The male factor responsible for infertility includes oligospermia. According to WHO criteria, oligospermia is sperm concentration less than 15 million per millilitre of semen. Vitamin D is a steroid hormone synthesized in the skin and derived from the diet. A serum level less than 20 ng/dl is regarded as vitamin D deficiency. The deficiency of vitamin D has been linked to many reproductive disorders. This study was designed to analyze the association between serum vitamin D level and oligospermia.***

Methods: ***A cross-sectional comparative study was conducted in the Department of Reproductive Endocrinology and infertility of Bangabandhu Sheikh Mujib Medical University, Dhaka, during the period of July 2018 to June 2019. There are 157 infertile males with oligospermia in one group and 157 infertile males with normozoospermia in another group. A base line semen analysis for evaluation of male infertility was done, and serum vitamin D level was estimated.***

Results: ***The mean vitamin D level is 16.75+5.75 ng/ml in males with oligospermia and 19.83+5.33 ng /ml in males with normozoospermia. By the threshold defined, all the infertile males are deficient in vitamin D. The difference between the circulating levels of vitamin D in the two groups is statistically significant ($p<0.05$). VitaminD deficiency is 4.25 times more in infertile males with oligospermia than in males with normozoospermia.***

Conclusion: ***Vitamin D deficiency is associated with oligospermia in infertile males.***

Keywords: Oligospermia, VitaminD deficiency

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Introduction

The male factor is responsible for about 30-40% of couples who are unable to conceive. We investigate the male partner for infertility with a semen analysis. Semen parameters that we look for include sperm count, sperm motility and sperm morphology. According to WHO criteria, sperm count less than 15 million per ml is oligospermia[1].

Vitamin D is a fat-soluble vitamin and a steroid hormone. The synthesis is mainly in the skin, induced by UV rays in sunlight, and a small amount is supplied in diet or food supplements. Vitamin D status of a person is assessed by the circulating levels of surrogate marker 25-hydroxy vitamin D. Serum 25 hydroxyvitamin D concentrations below 20ng /ml are considered as vitamin D deficiency[2]. The deficiency of vitamin D has been linked to health disorders, including reproductive dysfunctions. Vitamin D metabolizing enzymes are found in the male reproductive system. Vitamin D receptors are expressed in germ cells as well as in mature spermatozoa[3].

There have been conflicting observational studies on the association of circulating vitamin D levels with sperm count. The subject cohort has been both healthy fertile males as well as infertile males. Some studies[4-6] have found positive associations between vitamin D and sperm count, while others[7-9] have not found any association.

If an association between vitamin D deficiency and oligospermia is established, supplementation of vitamin D will be beneficial to infertile men deficient in vitamin D as a safe, easy and cost-effective measure to improve fertility. The objective of our study is to see if there is an association of serum vitamin D levels with oligospermia in infertile males.

Methods

The cross-sectional comparative study was carried out in the Department of Reproductive Endocrinology and

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Infertility from July 2018 to June 2019. The sample size was calculated at 80% power and 5% level of significance from a similar study[9]. The protocol was approved by the Ethical Review Board of Bangabandhu Sheikh Mujib Medical University. A total of 157 infertile males with oligospermia were the group I and 157 infertile males with normozoospermia were in group II. Those who had varicocele, smoking habits, systemic diseases like diabetes, hypothyroidism, renal and hepatic disease, known infections like sexually transmitted diseases or tuberculosis or had taken vitamin D in the last 6 months were excluded. The patients were briefed in detail regarding the objectives, rationality and potential benefits of the study and informed written consent was taken.

A baseline semen analysis for evaluation of male infertility was done in the Andrology lab of the department. Semen was collected after 3-5 days of abstinence. Makler counting chamber was used for semen analysis. Semen parameters were evaluated according to WHO criteria 2010. Serum 25(OH) was measured using a commercially available kit, the ARCHITECT Vitamin D assay. Chemiluminescent microparticle immunoassay was done for the quantitative determination of serum vitamin D. According to the guideline of the Endocrine Society; Vitamin D deficiency were the levels <20ng/ml, insufficiency 21-29 ng/ml and sufficiency ≥30ng/ml[2].

The statistical analysis was carried out by using the Statistical Package for Social Sciences version 22 for Windows (SPSS Inc, Chicago, Illinois, USA). Data were analyzed by unpaired t-test, chi-square test with an estimation of the odds ratio. A p-value of < 0.05 was considered statistically significant. Pearson correlation coefficient test, was done to see the correlation between serum vitamin D level with sperm count and sperm concentration.

Results

The study was done on 314 infertile males who had semen analysis as part of their infertility workup. Group I were the infertile males with oligospermia, a total of 157 in number, and group II were infertile males with normozoospermia, also total 157 in number. The socio-demographic and clinical characteristics of the two groups are listed in Table I.

The mean vitamin D level is 16.75 ±5.75 ng/ml in males with oligospermia and 19.83 ±5.33 ng/ml in males with normozoospermia. The difference between the circulating levels of vitamin D is statistically significant ($p<0.05$). By the threshold level defined, all the infertile males are deficient in vitamin D.

Vitamin D deficiency was present in 84.1% of males with oligospermia and in 55.6% of males with normozoospermia. Bivariate analysis reveals that vitamin D deficiency was significantly more in males with oligospermia than in males with normozoospermia. The calculated odds ratio was 4.25 (2.42-7.49), which means that vitamin D deficiency is 4.25 times more in infertile males with oligospermia than in males with normozoospermia (Table II).

Table I

Socio-demographic and clinical characteristics of subjects

Characteristics	Oligospermia (group I)	Normozoospermia (group II)	P-value
Mean age	33.5	33.5	0.958
Socio-Economic status:			
Low (%)	1.9	0.6	
Lower middle (%)	63.7	73.2	0.205
Upper middle (%)	33.1	24.2	
High Income (%)	1.3	1.9	
Residence			
Urban (%)	63.1	66.9	o.478
Rural (%)	36.9	33.1	
Type of infertility			
Primary (%)	60.5	54.1	0.254
Secondary (%)	39.5	45.9	
Mean BMI	24.65	24.68	0.909

Table II

Vitamin D levels ng/ml	Oligospermia (n=157)	Normozoospermia (n=157)	Odds ratio (95% confidence interval)	P value
≥20 ng/ml	132 (84.1%)	87 (55.4%)	4.25 (2.42-7.49)	0.001
>20 ng/ml	25 (15.9%)	70 (44.6%)		

Figure 1 and figure 2 shows that there is significant positive correlation of serum vitamin D levels with sperm concentration (r=0.264, p=0.001) and sperm count (r= 0.262, p=0.001).

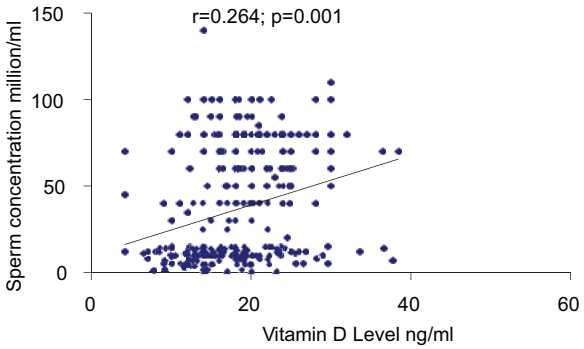

Figure 1. *Scatter diagram showing significant positive correlation (r=0.264; p=0.001) between vitamin D level and sperm concentration*

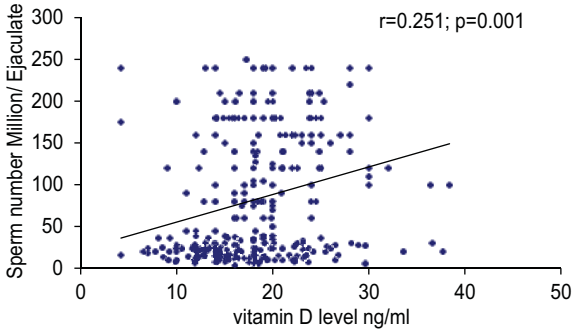

Figure 2. *Scatter diagram showing significant positive correlation (r=0.251; p=0.001) between vitamin D level and sperm number*

Discussion

The objective of the study was to find out if vitamin D is associated with oligospermia in infertile males. The study results show that there is a positive association of vitamin D with sperm count in infertile males. Vitamin D deficiency is 4.25 times more in infertile males with oligospermia than those with normozoospermia.

The infertile males with or without oligospermia in our study have vitamin D deficiency (levels <20ng/ml). This is because subclinical vitamin D deficiency is widely prevalent in India, Bangladesh and other countries of this part of the world. Studies reported mean serum vitamin D levels < 20ng/ml in 70-100% of apparently healthy subjects[10]. The reasons may be the lifestyle practices such as clothing and habits that limit sun exposure. Dark-skinned people have more melatonin, so less U-V ray induced synthesis of vitamin D in the skin. Vitamin D rich dietary sources like milk, animal fat are unaffordable or degraded by high phytate, low calcium content or high heat dependant cooking practices.

Hammoud et al. [4] did an observational study on 170 fertile, healthy men. Semen parameters in relation to categories of vitamin D levels were adjusted for age, BMI, season, alcohol intake and smoking. Total sperm count was lower in men with vitamin D levels < 20ng/ml compared to those with levels ≥20ng/ml and <50ng/ml. However, sperm concentration was lower in those with levels ≥50ng/ml compared to those with levels <20ng/ml and levels ≥20ng/ml, <50ng/ml. They suggested that serum vitamin D at high and low levels can be negatively correlated with sperm count.

Blomberg Jensen Met al[5] examined the relationship of vitamin D and semen parameters in infertile men. The study was based on the characteristics of 1427 infertile men recruited for a randomized controlled trial, the Copenhagen-Bone-Gonadal study. The total sperm number and sperm concentration were lower in those with lower levels of vitamin D, but the differences were not significant.

Zhu et al. [6]found a positive correlation of serum vitamin D levels with sperm count in infertile men. The vitamin D levels were not significantly different between fertile and infertile men, but the levels were significantly lower

in men with oligospermia than those in fertile men. They indicated that lower vitamin D could be a risk factor for poor semen quality in infertile men.

Ramlau Hansen et al. [7] did a cross-sectional study in Denmark on 345 young men. A high vitamin D level was unexpectedly associated with a lower crude median total sperm count. So they did not find any correlation between low vitamin D levels and low sperm count.

Blomberg Jensen M et al., [8] in their study, analyzed the association between semen quality and vitamin D levels of 300 fertile young men. They observed a positive association of vitamin D levels with sperm motility but not with sperm count.

Abbasimorzi et al. [9] compared mean vitamin D levels in normozoospermic men with those in men with oligo-astheno-teratozoospermia. The cross-sectional study was carried out on 278 men, including 186 with normozoospermia and 92 with oligo-astheno-teratozoospermia. In normozoospermic men, vitamin D levels were not correlated with semen parameters, and in men with oligo-astheno-teratozoospermia, only sperm motility showed a positive correlation with vitamin D.

When infertile men with vitamin D insufficiency is given supplementation with vitamin D and calcium, there is an increase in serum inhibin B concentration and an insignificant increase in sperm production[11].

The limitations of our study include factors like small size, single centre, short period and absence of random sampling. Other confounders causing reduced sperm count and number, particularly deficiency of other nutrients, were not adequately adjusted.

Conclusion

Vitamin D deficiency is associated with oligospermia in infertile males. So the correction of deficiency with vitamin D supplements may improve sperm count.

Conflict of interest

The authors declare no conflict of interest.

References

1. Cooper GT, Noonan E, von Eckerdstein S, Auger J, Baker HWG, Behre HM et al. World Health Organization reference values for human semen characteristics. Hum Rep Update 2010; 16930:231-35.
2. Holick MF, Binkley NC, Bischoff-Ferrari HA, Gordon CM, Hanley DA, Heany RP et al. Evaluation, treatment and prevention of vitamin D deficiency: an Endocrine Society clinical practice guideline. J Clin Endocrinol Metab 2011; 96(7): 1911-30.
3. Boisen IM, Hansen LB, Mortensen LJ, Lanske B, Juul A, Jensen MB. Possible influence of vitamin D on male reproduction. J of Steroid Biochemistry and Molecular Biology 2016; 173:215-22.
4. Hammoud AO, Meikle AW, Peterson CM, Joseph S, Gibson M, Douglus TC. Association of 25-hydroxy vitamin D levels with semen and hormonal parameters 2012; 14:855-59.
5. Blomberg Jensen M , Lawaetz JG, Andersson AM, Peterson JH, Nordkap L, Bang AK et al. Vitamin D deficiency and low ionized calcium are linked with semen quality and sex steroid levels in infertile men. Hum Reprod 2016; 31(8):1875-85.
6. Zhu CI, Xu QF, Li SX, Wei YC, Zhu GC, Yang C et al. Investigation of serum vitamin D levels in Chinese infertile men. Andrologia 2016; 48(10): 1261-66.
7. Ramlau-Hansen CH, Moeller UK, Bonde JP, Olsen J, Thulstrup AM. Are serum levels of vitamin D associated with semen quality? Results from a cross sectional study in young healthy men. Fertil Steril 2011; 95(3):1000-04
8. Blomberg Jensen M, Bjerrum PJ, Jessen TE, Nielsen JE, Joensen UN, Olesen IA, Petersen JH et al. Vitamin D is positively associated with sperm motility and increases intracellular calcium in human spermatozoa. Hum Reprod 2011; 26:1307-17.
9. Abbasihormozi S, Kouhkan A, Alizadeh AR, Shahverdi AH, Nasr Esfahani MH, Sadighi G et al. Association of vitamin D status with semen quality and reproductive hormones in Iranian subfertile men. Andrology 2016; 5(1):113-18.
10. Ritu G, Gupta A. Vitamin D deficiency in India: Prevalence, Causalities and Interventions. Nutrients 2014; 6:729-75.
11. Blomberg Jensen M, Lawetz JG, Petersen JH, Juul A, Jergensen N. Effect of Vitamin D supplementation on Semen Quality, Reproductive Hormones and Live birth Rate. A Randomized Clinical Trial. J Clin Endocrinol Metab 2018; 103:870-81.