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Vitamin D Acts as Bio-marker For Predicting IVF Success: A Case Study

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Abstract

This case study intends to validate the potential of Vitamin D as a biomarker for prediction of success of In Vitro Fertilization (IVF) using Assisted Reproductive Technology (ART). The study has analyzed the correlation of 25-hydroxyvitamin D (25(OH)D) and Anti Mullerian Hormone (AMH) concentration with age of 149 women underwent IVF by ART using Pearson test. Success rate of the above women in IVF was compared with 25(OH)D level. The study has confirmed positive correlation between 25(OH) D and AMH and negative correlation between 25(OH) D and age at statistically significant levels. Since AMH has already been identified as an indicator of ovarian reserve and IVF success, in medical literature, it can be concluded that 25(OH) D can be considered as a biomarker for predicting IVF success.

Keywords: 25(OH) D, AMH, biomarker, IVF, age, fertility.

Introduction

Vitamins play crucial role in regulating physiological processes like metabolism and growth of animals including man. Accordingly, hypo or hyper vitaminosis often lead to abnormal consequences[1]. Hormones in general and thyroid hormones in particular are another group of crucial factors influencing multiple physiological processes in mammals[2,3]. Vitamin D represents one of the fat soluble vitamins with wide range of physiological roles. Involvement of this vitamin in various physiological processes such as calcium and phosphorus homeostasis and bone mineralization has been confirmed in medical literature[4]. Under the influence of ultra-violet B radiation of sunlight, cholesterol in the skin gets converted into vitamin D. This precursor molecule is altered by the liver and kidney to the active form of the molecule known as 25 Hydroxy vitamin D (25(OH) D), which is the major circulating form of the vitamin in the blood. Recent reports suggest that this vitamin plays an important role in avoiding the risks of cancer, autoimmune disorders, diabetes and cardiovascular diseases[4-6]. Involvement of vitamin D on reproductive health of men and women has also been reported recently by several studies[7-10]. Few other vitamins like vitamin B1 and vitamin C are being used for the treatment of disorders and environmental poisoning[11,12].

Infertility is a major cause of concern during recent times. A survey on causes of infertility has indicated predominance of female factors[13]. In an extensive review, effects of vitamin D on fertility of males and females, have been analyzed and it has been concluded that optimum level of this vitamin is crucial for the healthy reproductive state of both the sexes[14]. Among women vitamin D has been reported to regulate the concentration of Anti Mullerian Hormone (AMH) in blood[15]. AMH is produced by developing follicles and hence indicates the ovarian reserve (i.e. number of immature eggs in the ovaries). This is a crucial factor determining the success of Assisted Fertility Technology (ART) through In Vitro Fertilization (IVF) among women.

25(OH) D is the dominant form in which Vitamin D exists in circulating blood and hence serum can be used as reliable source for the quantification vitamin D level in an individual. This in turn would be linked to AMH and hence can be used as a biomarker for predicting the success of ART in IVF outcomes. Current study has made an attempt to validate the above hypothesis in a population of 149 women who had opted for IVF.

Material and Methods

A population of 149 women who underwent IVF through ART at different hospitals and received diagnostic and screening services from Renuka Diagnostic Laboratory, Bangalore during 2010-2011 have been considered for the current study. Pretreatment values of 25(OH) D and AMH obtained from the above individuals are compiled and analyzed for evaluating their influence on success rate of ART through IVF.

Vitamin D volumetric analysis: Pre - treatment status of Vitamin D in the study population was quantified by quantifying 25(OH) D in frozen serum samples (-20ºC) without thawing by 25(OH)-vitamin Xpress DELISA Kit [Lilac Medicare (P) Ltd.].

Serum AMH quantification: Serum AMH concentration of the study population was quantified by AMH Gen II ELISA Kit

[Beckman Coulter Ireland Inc.] using frozen serum samples (-20ºC) without thawing.

Statistical analysis: Mean and standard deviations of the values of circulating 25(OH) D and AMH were calculated for different age groups of women.

Correlation of 25(OH) D and AMH with age of the women has been analyzed by Pearson test using Graphpad 5.3 version.

Results and Discussion

Novel diagnostic strategies of clinical conditions are being extensively employed in current treatment regimes. Image processing techniques are considered as a powerful technique for diagnosis of diseases[16]. Identification of biomolecules as markers for diagnosis and monitoring of the patient response during treatment of various disesases and disorders. IL-12+P40 have been reported as the ossibble biomarkers for tuberculosis[17]. Plasma level of cholesteryl ester transfer protein (CETP) has been proved to be indicative of lipid profile of individuals with metabolic syndrome[18]. Similarly, levels of bone mineral density has been opted as a reliable marker for osteoporosis[19].

Mean levels of 25(OH)D and AMH among women belonging to different age groups are presented in Table1. The data has revealed difference in the levels of both factors among women of different age groups. Result of the correlation analysis of 25(OH)D and AMH with age of the study population is presented in figure 1. The Pearson test has demonstrated significant negative correlation of vitamin D (Pearson r = -0.3435) with age. Meanwhile the test has established positive correlation (Pearson r = 0.7747) of vitamin D with AMH. The success rate of IVF in the population of this study is presented figure 2.

Women with the age group 21- 30 showed highest success rate and those of above 40 years showed least success in IVF. Consideration of all the three factors, i. e. 25(OH)D concentration, AMH status and success rate of IVF, it can be concluded that 25(OH)D concentration in the serum is a highly potential factor as indicator of the prospects of IVF. Earlier investigations have revealed the association of serum AMH levels with ovarian response of women undergoing IVF[20]. Strong association of optimal level of AMH with live-birth rates has also been reported by Brodin et al[21] .

From these reports and the outcome of current study it can be concluded that AMH concentration is a critical factor deciding the success of IVF. Since 25(OH) D shows direct positive correlation with AMH concentration of individuals, this can be used as an ideal marker for monitoring the response of ART patients towards the treatment and predicting their success in IVF.

Table-1
Mean Vitamin D and AMH levels among individuals of different age groups

Age group	Vit D in nmol/L (Mean±SD)	AMH in ng/ml (Mean±SD)
21-30yrs	21.55±8.58	0.27±0.23
31-40yrs	18.47±7.97	0.33±0.29
> 40yrs	19.68±7.88	0.35±0.23

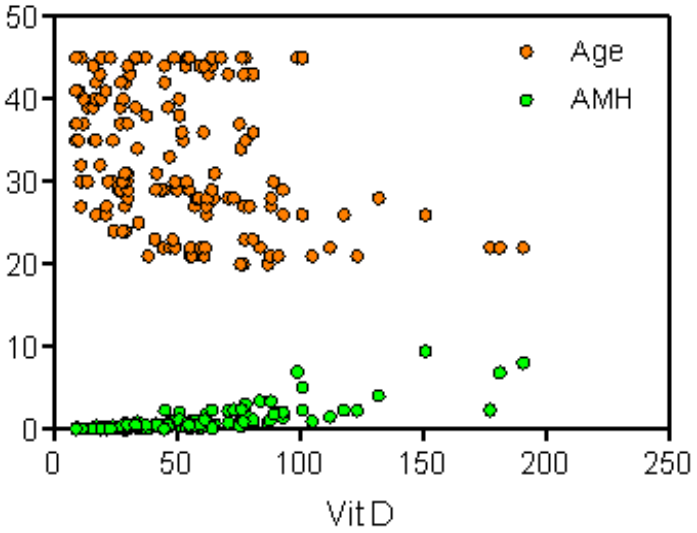

Figure-1
Correlation of circulating 25(OH) D and AMH with age

	AGE	AMH
Number of XY Pairs	149	146
Pearson r	-0.3435	0.7747
95% confidence interval	-0.4780 to -0.1934	0.7004 to 0.8324
P value (two-tailed)	< 0.0001	< 0.0001
P value summary	***	***
Is the correlation significant? (Alpha=0.05)	Yes	Yes
R squared	0.118	0.6002

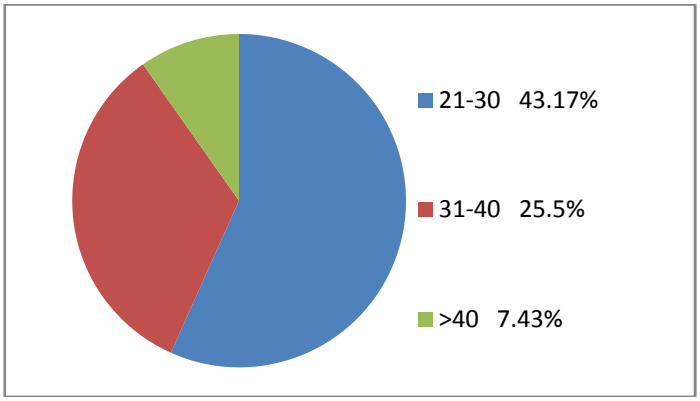

Figure-2
Success rate of IVF among women of different age groups

Conclusion

Current study has confirmed significant positive correlation of 25(OH)D concentration in blood with AMH concentration which in turn is a decisive factor in IVF success rate. Therefore, the study has confirmed the prospects of 25(OH)D for its application as biomarker in predicting the success of ART and IVF.

References

1. Shama R.L., Sharma K.K. and Sharma N., Hypervitaminosis – A causes degenerative changes in thyroid of mouse, *Res. J. Recent Sci.*, **1**, 26-30 (**2012**)

2. Idris A., Idris O.F. and Sabahelkhier M. K., The effect of hyperthyroidism on plasma FSH and LH concentrations in females of Wistar rats, *Res. J. Recent Sci.*, **1**, 55-57 (**2012**).

3. Jayshree J. and Ismail B., Studies on human thyroid disorders based upon assay of TSH nd thyroid hormones in Ujjain, M.P., India, *ISCA J Biol. Sci.*, **1**, 43-47 (**2012**)

4. Holick M.F.,Vitamin D deficiency, *New Eng. J. Med.*, **357**, 266–281 **(2007)**

5. Pilz S., Dobnig.H., Winklhofer-Roob B., Riedmu¨ ller G., Fischer J. E., Seelhorst U., Wellnitz B., Boehm B.O . and Ma¨rz W., Low serum levels of 25-hydroxyvitamin D predict fatal cancer in patients referred to coronary angiography, *Cancer Epidemiology, Biomarkers and Prevention*, **17**, 1228–1233 **(2008 a)**

6. Pilz S., Ma¨rz W., Wellnitz B., Seelhorst U., Fahrleitner-Pammer A., Dimai H.P., Boehm B.O. and Obnig H., Association of vitamin D deficiency with heart failure and sudden cardiac death in a large cross-sectional study of patients referred for coronary angiography, *J. Clin. Endocrinol. and Metabolism,* **93**, 3927–3935. **(2008 b)**

7. Lewis S., Lucas R.M., Halliday J. and Ponsonby A.L., Vitamin D deficiency and pregnancy from preconception to birth, *Mol. Nutrition and Food Res.,* **54**, 1092–1102 **(2010)**

8. Kovacs C.S., Vitamin D in pregnancy and lactation: maternal, fetal, and neonatal outcomes from human and animal studies, *Am. J. Clin. Nutrition,* **88**, 520S–528S **(2008)**

9. Pilz S., Frisch S., Koertke H., Kuhn J., Dreier J., Obermayer-Pietsch B., Wehr E.Z.A., Effect of vitamin D supplementation on testosterone levels in men, *Hormone and Metabolic Research*, **43**, 223–225 **(2011)**

10. Wehr E., Pilz S., Boehm B.O., Ma¨rz W. and Obermayer-Pietsch B., Association of vitamin D status with serum androgen levels in men, *Clin. Endocrinol.,* **73**, 243–248 **(2010)**.

11. Tofighi Niaki M., Zafari M. and Aghamohammady A., Comparison of the effect of Vitamin B1 and acupuncture on primary dysmenorrhea, *ISCA J Biol. Sci.,* **1**, 62-66. **(2012)**

12. Somayeh B., Mohammad F., Vitamin C can reduce toxic effects of nano zinc oxide, *Int Res J Boil. Sci.*, **3**, 67-70 **(2014)**

13. Patel M., Jain S., Jain D., Patel B., Phanse N., Vyas P. and Rathore P., Prevalence of different factors responsible for infertility, *Res. J. Recent Sci.*, **1,** 207-211 (**2012**)

14. Lerchbaum E. and Obermayer-Pietsch B., Vitamin D and fertility: a systematic review, *Eur J Endocrinol.,* **166**, 765–778.doi: 10.1530/EJE-11-0984 **(2012)**

15. Merhi O.Z., Seifer B. D, Weedon J., Adeyemi O.H. R.N., Anastos K.G.T.E., Young M. K. R., Greenblatt R., and Minkoff H., Circulating Vitamin D Correlates with Serum Anti-Mullerian Hormone Levels in Late Reproductive-Aged Women, Women's Interagency HIV Study, *Fertil. Steril.*, **98**, 228-234 **(2012)**

16. Yasmin M., Sharif M. And Mohsin S., Survey paper on diagnosis of breast cancer using image processing techniques, *Res. J. Recent Sci.*, **2**, 88-98. (**2013**).

17. Shnawa I M S A W., Obyes Al-Mammori R. T. And Mohammed G. J., The assessment of IL-12 +P40 among primary pulmonary and chronic (old) pulmonary tuberculosis, *Int Res J Boil. Sci.*, **2**, 1-4. **(2013)**.

18. Goodrazi M. T. , Mohammadian M., Borzouei S. and Hassanzadeh T., Association between plasma cholesteryl ester transfer protein activity and lipid profiles in metabolic syndrome in an Iranian population, *Int Res J Boil. Sci.*, **3**, 89-90. **(2014)**.

19. Shaikh A.B., Sarim M., Raffat S. K., Khan M. And Chinoy A., Bone mineral density correlation against bone radiograph texture analysis: an alternative approach, *Res. J. Recent Sci.*, **2**, 89-91. (**2013**).

20. Rooij Van I.A.J., Broekmans F.J.M., Veldete E.R., Fauser B.C.J.M., Bancsi L.F. J. M. M., Jong de F.H. and Themmen A. P. N., Human Reproduction, *Oxford Journals*. **17**, 3065–3071 **(2002)**

21. Brodin T., Hadziosmanovic N., Berglund L., Olovsson M. and Holte J., Antimullerian hormone levels are strongly associated with live-birth rates after assisted reproduction, *J Clin.Endocrinol. Metabol.*, **98**, 1107-1114 **(2013)**