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Correlation of Serum 25-Hydroxyvitamin D and Thyroid Hormones in Pregnant Women in Amman-Jordan

Abstract

Aim: The aim of this study is to investigate changes of vitamin D and thyroid hormones levels during pregnancy to maintain normal fetus development and growth.

Method: Serum hydroxyl vitamin 25(OH)D and thyroid levels were measured in109 pregnant women referred to our laboratory from prenatal clinic during the period of May to October 2015.Blood samples were detected for 25 (OH) vitamins D, TSH, FT4 and FT3 by chemiluminescent (Tosoh A1A, Japan).

Results: Pregnant women aged 19-45years (18.2 years age average) were examined. The mean 25(OH) D was 21.7±5.6 ng/ml (range 8.7 to 47.2). The mean levels of Serum Free T3, FT4 and TSH were 1.61 ± 0.21, ng/dl, 0.86 ± 0.23 ng/dl and 1.56 ± .9 µIU/ml respectively, results for 25(OH) D mean values were 29.5 ng/ml (27.9%), 33.2 ng/ml (49.6%) and 37.3 ng/ml (22.5%) for vitamin D deficiency, insufficiency and sufficiency respectively. No correlation was found between vitamin D, TSH, FT4 and FT3 however, there was statistical significant correlation between the vitamin D and TSH ($p<0.05$), level especially in patients with sufficient vitamin D level.

Conclusion: Association between higher vitamin D (>30.0 ng/ml) and lower TSH in pregnant was observed ($P<0.005$). However, no correlation between 25-Hydroxyvitamin D FT4 and FT3 hormone was observed.

Keywords: 25-Hydroxy vitamin D; Thyroid stimulating hormone (TSH); Thyroxin (FT4); Triiodothyronine (FT3); Vitamin D (25-(OH))D

Research Article

Volume 4 Issue 1 - 2017

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Received: May 02, 2016 | **Published:** January 31, 2017

Introduction

Vitamin D is important for fetus good health, growth and strong bones [1]. Vitamin D deficiency (VDD)is a global and public health problem in many countries [1,2]. Vitamin D deficient or insufficient have been reported in many people and pregnant women are not exceptional. Vitamin D deficiency in pregnancy is still a public health issue [3] and increasing evidence shows that vitamin D deficiency/insufficiency leads to a series of adverse outcomes for pregnant women and their offspring. They have been identified as a high-risk group, among whom the prevalence of VDD ranges between 20 and 40% [1]. Deficiency in vitamin D was linked to a variety of different health problems, from depression to cancer, and osteoporosis to Parkinson's disease. Risk of heart disease and diabetes and their diseases .Vitamin D deficiency and/or VDRs gene polymorphism were associated with many kinds of autoimmune disorders, including type 1 diabetes mellitus, erythematosus systemic lupus, multiple sclerosis rheumatic arthritis [4-7]. It was reported that vitamin D deficiency associated with autoimmune diseases necessary and supplementation prevents the onset and/or development of these autoimmune diseases [10,11] which is needed for development of skeletal muscle due to involvement in calcium homeostasis [2,12]. Therefore understanding sources of vitamin D supplementation is vital to reduce risk on mother and fetus. Major vitamin D sources is cutanuse synthesis via exposure to sunlight (95%) and dietary intake account for 5% [12]. Moreover vitamin D is a fat-soluble which is stored in body fat and liver [11,12] through complex pathway involve kidney [1,2,12]. The ultimate conversion of supplemented Vitamin D occurs in the liver to 25-Hydroxyvitamin D which is the most widely accepted indicator of vitamin D because serum 25(OH) D has longer half-life of approximately two to three weeks than 1, 25-$(OH)_2$ D with a shorter circulating half-life of fifteen hours [2,13] and it is the best indicator of total vitamin D status which is restore from sunlight exposure, diet and conversion from adipose stores in the liver [14,15]. International vitamin D Levels of 30 to 32 ng/ml, 20 to 29 ng/mL and <12 ng/ml are considered to be sufficient, insufficient and deficient respectively, [16].There are other factors reported to affect vitamin D status such as, geographic zone, season, dietary habits, race/ethnicity, cultural and religious factors, smoking and drinking, supplementation, sunscreen use , education and body mass index (BMI) [17, 28]. To date, vitamin D deficiency in pregnancy is still a public health issue [3]. Our interest in this study rises from the documented link between vitamin D and thyroid hormone since both are bind to similar receptors [9] and both vitamin D deficiency and thyroid dysfunction/autoimmunity can cause different diseases such as preeclampsia, gestational hypertension, gestational diabetes mellitus, premature delivery, low birth weight, and impaired neurodevelopment of offspring [29,37]. Therefore to

maintain healthy pregnancy and fetus skeletal development and to prevent pre-eclampsia optimum level of Vitamin D should be maintained to ensure fetus health [10]. Many studies have shown the role of vitamin D in autoimmune thyroiditis however, few studies examined the role of 25 (OH)D in association with thyroid hormones in pregnancy and conflict results reported on the association of 25(OH)D levels in pregnancy and adverse effects on maternal and fetal health [11,37,38]. Thus, it is advisable to review VDD in mothers and their children so that strategies can be implemented to prevent VDD in pregnancy and lactation, in order to prevent impact on the fetus, newborn and in childhood, aiming at a possible reduction in the future development of chronic diseases in adulthood [38,39]. The aim of this study is to investigate the relationship between 25-Hydroxyvitamin D status and circulating TSH, FT4, FT3 levels in pregnant women live in sunny Jordan.

Materials and methods

One hundred and nine pregnant women were referred to laboratory for vitamin D and thyroid levels tests from prenatal clinic during the period May to September 2015. Blood samples were analyzed within two hours using (Tosoh A11, Japan). Patients were not on rehabilitation drug therapy, neither on vitamin D supplement. Patients were tested for Thyroid Peroxides Antibody (TPOAb) and Thymoglobulin Antibody (TgAb) to exclude the presence of autoimmune thyroid disease (AITD) and the elevated antibody peroxides or thymoglobulin [2]. Blood samples were tested for FT3, FT4, TSH and 25 (OH) vitamins D. Reference range (1.2-4.4 pg/ml for FT3), (0.8–2.0 ng/dl for FT4) and (0.5–5.0 mU/l for TSH) [40]. Vitamin D serum level was defined as deficiency, insufficiency and normal for serum level of 25 (OH) D of < =20 ng/ml, between 20 ng/ml and <30 ng/ml and normal >or=30 ng/ml respectively [16].

Statistical analysis

Results were statistically analyzed by SPSS 11.5 for Windows. The mean and the standard deviation (SD) for all the variables were calculated. Analysis of variance F test (ANOVA) was used to compare the results of all examined cases in all studied groups. The differences between mean values for each tested variable have been tested by student's "t" test. The correlations between serum Vitamin D and TSH were presented by correlation coefficient (r^2). Results considered non-significant or significant when *P*> or < 0.05, respectively [11].

Results

One hundred and nine pregnant women aged 19-45years (18.2 years age average) were examined. The mean 25(OH) D was 21.7±5.6 ng/ml (range 8.7 to 47.2). The mean level of serum Free T3, FT4 and TSH was 1.61 ± 0.21, ng/dl, 0.86 ± 0.23 ng/dl and 1.56 ± .91 µIU/ml respectively, number of patients showing vitamin D deficiency, insufficiency and sufficiency were 30 (27.5%), 54 (49.5%) and 25 (23.0%) respectively, with mean concentration of 25(OH) D serum of 17.4ng/ml,28.3 ng/ml and 34.7 ng/ml respectively, Table1. No significant correlation was found between vitamin D, TSH, FT4 and FT3 Table2. No correlation was observed between vitamin D and FT4 (r = -0.064 p<0.01) and between vitamin D and FT3 (r=- 0.071 p<0.01) however, vitamin D sufficient group showed significant correlation with TSH(r= 0.51 p<0.005).

Table 1: Mean level of vitamin 25 (OH) D to age and number of patients.

25(OH)D Range	No and % of Patients	Age Mean (Y)	Mean 25(OH)D ng/ml
<20	30(27.5%)	29	17.4
21-30	54(49.5%)	33	28.3
>30	25 (23.0%)	27	34.7
Total	109	29.7	

Table 2: Correlation between vitamin 25 (OH) D levels, TSH, FT4 and FT3.

25(OH)D Range	No of Patients	Age Mean (Y)	FT3 pg/ml	FT4 ng/dl	TSH ulu/ml	r FT4	r TSH	rFT3	pFT4	p *FT3*	P TSH
<20	30(27.5%)	29	1.11	0.91	1.33	0.004	-0.11	0.005	<0.01	<0.01	<0.01
21-30	54(49.5%)	33	1.63	0.84	1.59	-0.17	0.019	-0.31	<0.01	<0.01	<0.01
>30	25(23.0%)	27	2.1	0.83	1.76	-0.06	-0.51	-0.042	<0.01	<0.01	<0.005
Total	109	29.7	1.61	0.88	1.58	-0.23	-0.067	-0.28	<0.01	<0.01	<0.015

Discussion

Significant of vitamin 25(OH) D was reported as a common condition throughout the world [41] and deficiency/insufficiency range from 5% to 83.6% [29,43]. During pregnancy can cause a series problems for pregnant women and their offspring [2]. Recent studies have shown an increase of vitamin D insufficiency in the Mediterranean region [2]. Jordan is close to that region and comparative study could lead to a significant outcome. Results in our study revealed 49.0% prevalence of 25 hydroxyvitamin D insufficiency in pregnant subjects who lived mainly in sunny zone which agree with other study [2] indicating that high levels of sunshine in Jordan might not necessarily compensate for vitamin D deficiency. Therefore, other factors should be investigated to understand the cause of vitamin D depletion during pregnancy so the right vitamin D concentration could be achieve .Heijab might have negative effect on vitamin D cutaneous synthesis [44]. Many studies have shown significant relationship between serum 25-Hydroxyvitamin D and thyroid hormones during pregnancy due to the role of vitamin D in the function of cardiac, skeletal muscles, immune cell proliferation and differentiation [2]. As mentioned previously 25(OH) D status is Influenced by many factors [2,11,44] one of these factor is thyroid hormones changes by fetus action causing depletion of TSH, FT4 and FT3 leading to various problems such as placental abruption, miscarriage, fetal growth retardation [49]. Other studies recommended vitamin D supplementation during pregnancy [8,12,25].

Many studies showed role of vitamin D on thyroid hormone due to its activity in thyroid gland [2,11] and even in patients with thyroid diseases and thyroid autoantibody [46,47]. However, few studies focus on the link between 25-(OH)D and thyroid hormones during pregnancy. Therefore this study was conducted on group of pregnant women who lives in sunny Jordan and Heijab is prevailing. The significant correlation between high vitamin D and low TSH ($p< 0.005$) in pregnant women with a sufficient level of vitamin D (> 30 ng/ml) revealed in our study which agrees with other study [2]. Meanwhile no significant statistical variation was found ($p<0.01$) between vitamin D level and FT4 which agree with other studies [2,9,11] adding to that correlation between vitamin D and FT3 ($p< 0.01$) was not clear suggesting further work is needed [9,11] including larger study sample of pregnant women divided according to weeks of pregnancy, age and those wearing Heijab [44]. Meanwhile if the responsible factors for vitamin D deficiency could not be revealed so that the correct concentration of vitamin D could maintain in pregnant women public health awareness should be reused and recommendation for vitamin D supplementation before and after pregnancy is extremely important.

Conclusion

Our results indicated that slight correlation between vitamin D insufficiency and low TSH level during pregnancy was observed however, no evidence was provided on the correlation between vitamin D, FT3 and FT4 therefore more research must be conducted on group of pregnant women divided according weeks of pregnancy, age and Heijab meanwhile, recommendation for vitamin D supplementation is recommended.

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Citation: Nizar BM, Battikhi ZW, Battikhi BE (2017) SCorrelation of Serum 25-Hydroxyvitamin D and Thyroid Hormones in Pregnant Women in Amman-Jordan. J Microbiol Exp 4(1): 00099. DOI: 10.15406/jmen.2017.04.00099

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