Effect of Progesterone-only Contraception on Vitamin D in Human Milk

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Abstract

Objective: Nowadays progesterone contraceptives are being used by lactating women. In the last century elements effective in bone growth in infants, such as calcium, phosphorus and vitamin D have been evaluated. Vitamin D has been mentioned mainly in relation to rickets prevention in infants. This study was initiated in order to investigate the effect of Progesterone-only contraceptives on breast milk vitamin D.

Material & Methods: In this cohort study 138 lactating women were assigned to either the hormonal (52 participants) or non-hormonal (86 participants) groups according to their chosen method of contraception. The characteristics and goals of the study were explained in detail and informed consent was obtained from all subjects before inclusion in the study. Research units started their method of contraception 45 (7) days postpartum and continued at least for 6 months afterward. 10 ml milk samples were obtained before the baby nursed at 6 mos postpartum, and kept at -20 °C until analysis. Vitamin D levels were measured with RIA method.

Findings: Vitamin D levels were found to be 11.2 (7.2) nmol/L in the hormonal and 10.67±6.6 nmol/L in the non-hormonal groups, which was lower than other cultures. There was not a significant difference between the vitamin D levels of the two groups statistically (P>0.05).

Conclusion: According the results, the consumption of progesterone-only contraceptives had no effect on the vitamin D levels of mothers' milk, although with regard to low levels of vitamin D in the milk of lactating mothers, it is necessary to enrich foods with vitamin D and for mothers to use vitamin D supplements.

Key Words: Vitamin D; Human milk; Contraceptive; Progesterone-only contraception

Introduction

Vitamin D deficiency is re-emerging as a significant health problem[1]. While the importance of vitamin D in infancy has been focused on protection from rickets, emerging research suggests that optimal vitamin D status may play a role in the protection against...
the development of other diseases. Scientific evidences are linking low circulating 25-hydroxyvitamin D to increased risk of osteoporosis, diabetes, cancer, heart disease, depression, hypertension, periodontal disease, schizophrenia, tooth loss and autoimmune disorders like multiple sclerosis and rheumatoid arthritis.

During the last decade a greater appreciation has developed for determining what factors influence bone mineral accretion in healthy children. Part of this interest can be attributed to the suggestion that osteoporosis has its origins in childhood. Zamora and co-workers in a retrospective study of prepubertal girls found that those who received vitamin D supplements during the 1st y of life had greater BMD (Bone Mineral Density) at the radius, femoral neck, and greater trochanter. Poor infant skeletal growth and mineralization, and poor infant tooth mineralization could be related to moderately low plasma 25-hydroxyvitamin D concentrations.

Direct exposure to ultraviolet radiation and dietary intake are the two main sources of vitamin D. Latitude, time of day, season of the year, increased use of sunscreen, amount of skin exposed, pigmentation of the skin and air pollution have a dramatic effect on the quantity of vitamin D produced in the skin. Several studies found relation between breast milk vitamin D with education, obesity and parity.

The skin has a high capacity to synthesize vitamin D, but if sun exposure is low vitamin D production is insufficient, especially in dark-skinned infants. Many dermatologists who are concerned about the anticipated 55000 annual cases of melanoma, the most deadly form of skin cancer, have dismissed the importance of exposure to sunlight. Despite the high prevalence of vitamin D insufficiency, these experts consider the health risks to be small compared with the danger of melanoma. Furthermore, the centers for Disease Control and Prevention, AAP (American Academy of Pediatrics) and the American Cancer Society warned people to limit exposure to ultraviolet light to decrease the incidence of skin cancer. Even infants younger than 6 months should be kept out of direct sunlight, children's activities that minimize sunlight exposure should be selected, and protective clothing as well as sunscreens should be used. But, the use of sunscreen with a sun protection factor (SPF) of eight reduces the cutaneous production of vitamin D by 97.5% in adults.

Exclusive breast-feeding is now recommended by all international agencies for the first 6 mos of life. In spite of its benefits for infant health and survival, breast milk is a poor source of 25-(OH) D and breastfed infants are at higher risk of vitamin D deficiency than others. Hypovitaminosis D occurs because sun exposure is extremely limited for both mothers and infants and dietary supplementation at the current daily recommended intake (DRI) of 400 IU/d is inconsequential. Hypovitaminosis D among breast-fed infants is a severe problem even in sunlight-rich environments such as Middle East, being considered in the study of Hashemipour S, et al, in Iran, 80% of subjects had mild, moderate or severe hypovitaminosis D.

Lactation is a complex physiological process that is influenced by numerous endogenous hormones and exogenous factors. Progestin-only oral contraceptive studies have shown a mixture of effects on milk supply, and certain forms of progesterone exhibit a dose-dependent suppression of lactation secondary to peripheral conversion to estrogen which is also responsible for a change in milk contents. This study was initiated in order to investigate the effect of Progestin-only contraceptives on breast milk vitamin D, and relations between breast milk vitamin D with BMI, age and number of parity.

Material & Methods

The study was carried on lactating mothers, attending Tehran health-care centers (2006). They started their method of contraception 45(±7) days postpartum and continued at least for 6 months afterward. The characteristics and goals of the study were explained in detail and informed consent was obtained from all subjects before inclusion in the study.
In this cohort study 138 lactating women were assigned to either the hormonal (52 participants) or non-hormonal (86 participants) groups according to their chosen method of contraception. The subjects, based on their contraceptive method were divided into two groups, 52 women received progesterone-only methods [Progesterone Only Pill (POP) or Depoedroxy Progesterone Acetate (DMPA)] and 86 of them received non-hormonal contraception [Intra Uterine Device (IUD), Condom or sterilization]. All the mothers were apparently healthy. The characteristics of two groups were similar at the time of admission; none of them received vitamin D supplement.

At 6 month postpartum, before nursing the baby, 10 ml of each mother's milk were expressed. Samples were frozen immediately after collection and stored at -20°C until analysis was carried out. Vitamin D content of each sample was measured by the RIA method.

Two groups were compared at entrance into the study, for determination of potential differences with respect to sociodemographic and baseline clinical characteristics. Statistical analysis was performed using SPSS version 12. Student’s t-test and X² were used for evaluation.

**Findings**

The groups did not differ according to age, weight, height, BMI, education, occupation, number of pregnancies, infant sex and birth weight. The baseline characteristics of the subjects in two groups are shown in table 1.

Mean (and standard deviation) of breast milk vitamin D in hormonal group was 11.2 (7.2) and in non-hormonal group was 10.7 (6.6). The difference was not statistically significant (P>0.05).

Breast milk vitamin D didn't relate with maternal BMI and education (P>0.05), however Vitamin D in breast milk increased until third parity (P<0.05).

**Discussion**

Global high prevalence of vitamin D insufficiency specially in Iran and re-emergence of rickets, even in industrialized countries despite fortifying some foods, and the growing scientific evidence are linking low circulating 25-hydroxyvitamin D to increased risk of osteoporosis, diabetes, cancer, autoimmune disorders and some other diseases, motivated us to do this investigation.

Adequate concentration of circulating 25-hydroxyvitamin D [25 (OH) D] is critical to maintaining the health and function of the immune, reproductive, musculoskeletal and integumentary system of men and women of all ages and races[4].

Human milk typically contains a vitamin D concentration of 25 IU/L or less. Breastfed infants are at increased risk of developing vitamin D deficiency or rickets[10]. Vitamin D deficiency prevalence is much higher in Asian countries; the studies carried out in the preceding two decades have shown a high prevalence of vitamin D deficiency in tropical countries such as China, Turkey, India, Iran and Saudi Arabia and some other Asian countries[17-25].

**Table 1- The characteristics of two groups at the time of admission**

<table>
<thead>
<tr>
<th></th>
<th>Mothers N=138</th>
<th>Hormonal N=52</th>
<th>Non-hormonal N=86</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>25.11</td>
<td>44224.77</td>
<td></td>
</tr>
<tr>
<td><strong>BMI (Kg/m²)</strong></td>
<td>24.26</td>
<td>25.84</td>
<td></td>
</tr>
<tr>
<td><strong>Parity</strong></td>
<td>11.79</td>
<td>1.181</td>
<td></td>
</tr>
<tr>
<td><strong>Human milk vitamin D</strong></td>
<td>11.19</td>
<td>10.67</td>
<td></td>
</tr>
</tbody>
</table>

*The difference between mean of breast milk vitamin D in hormonal group and in non-hormonal group was not statistically significant (P>0.05).*
Vitamin D deficiency can result in rickets, a painful disease characterized by softening of bones and growth plates. In Canada, it was reported that 85% of all patients suffering rickets had been breastfed[26]. Also, in Iran, Rafii reported 29% of 140 cases of rickets in Bahram Children’s Hospital were less than six months of age[25]. Even moderately low plasma 25-hydroxyvitamin D concentrations observed in Parisian women at the end of winter were associated with poor fetal and infant skeletal growth and mineralization, and poor infant tooth mineralization[28].

In the present study breast milk vitamin D in both groups was low, and no statistically significant difference was observed between the two groups.

In a study in Tehran that was carried out by Hashemipour et al, 1210 adults ranging between 20 and 64 years old were randomly selected and their serum levels of 25(OH) D were measured. It showed that, prevalence of severe, moderate and mild Vitamin D deficiency were 9.5%, 57.6% and 14.2%, respectively[14], which was similar to our results. Also, in a series of 82 wrist X-rays performed for children less than 5 years of age admitted to a hospital in Tehran, signs of rickets were reported in 15% of the cases[27].

Direct exposure to ultraviolet radiation and dietary intake are the two main sources of vitamin D. The skin has a high capacity to synthesize vitamin D, but if sun exposure is low vitamin D production is insufficient, especially in dark-skinned infants[5]. Some factors like air pollution, pigmentation of the skin, latitude, time of day, season of the year, use of sunscreen, dressing habits have a dramatic effect on the quantity of vitamin D produced in the skin[3,7,10,29,30].

In India, in a study enrolling 9-24 month-old infants with the same socioeconomic conditions and no vitamin D supplementation, the group living in the region with intensive air pollution had lower serum 25-hydroxyvitamin D levels than those living in the country with no air pollution (12.6 nmol/L versus 28.2 nmol/L)[30]. Tehran, the site of audit, has intensive air pollution that prevents optimal exposure to sunlight. In addition, mothers’ dressing habits, low dietary vitamin D intake, lack of vitamin supplementation, little time spent outside home, air pollution, sunscreen use contribute to vitamin D deficiency.

There are other hypotheses to explain vitamin D deficiency among Asians. Awumey et al showed higher activity level of 24-hydroxylase in fibroblasts of Asian Indians in America compared with controls. Therefore, increased vitamin D catabolism may cause vitamin D deficiency in Asians[31].

Obese individuals, as a group, have low plasma concentrations of 25(OH) D, obesity impairs vitamin D utilization in the body, meaning obese people need twice as much vitamin. Wortsman et al found BMI was inversely correlated with serum vitamin D3 concentrations after irradiation and with peak serum vitamin D2 concentrations after vitamin D2 intake[8]. However in this study no relationship was found between breast milk vitamin D content and BMI of the mothers.

Pehlivan et al, in Turkey found no correlation between the parity and vitamin D deficiency[3], but in this study we found correlation between the number of pregnancies and breast milk vitamin D, that was the vitamin D increase till third parity and the decrease afterwards.

In the same study from Turkey, Ismail and colleagues found positive correlation between serum 25-OH-vitD level and educational status[7]; however, we found no relationship between education and vitamin D in mothers’ milk.

Dermatologists and cancer experts advise caution in exposure to the sun, especially in childhood, and recommend regular use of sunscreens. Sunscreens markedly decrease vitamin D production in the skin. Furthermore, the Centers for Disease Control and Prevention, with the support of many organizations including the American Academy of Pediatrics (AAP) and the American Cancer Society, have recently launched a major public health campaign to decrease the incidence of skin cancer by urging people to limit exposure to ultraviolet light. Indirect epidemiologic evidence now suggests the age at which direct sunlight exposure is initiated is even more important than the total sunlight exposure over a lifetime in determining the risk of skin cancer. Thus,
guidelines for decreasing exposure include directives from the AAP that infants younger than 6 months should be kept out of direct sunlight, children’s activities that minimize sunlight exposure should be selected, and protective clothing as well as sunscreens should be used[10].

We found no previous study about this subject, but on the basis of this audit no correlation was found between human milk 25(OH)D level in two groups, so it seems POP and DMPA do not have any adverse effects on vitamin D. However, further study is needed to demonstrate these findings. As seen in our results and that of Hashemipour et al there is serious maternal vitamin D deficiency in Tehran. Due to the vitamin D deficiency observed in this study and related ones, it is really emphasized to enrich foods with vitamin D, to use vitamin D supplements in breastfeeding mothers, and to educate them how to conquer vitamin D deficiency.

Some authors believe a RDA of 400 IU/d (10µg/d) in adults seems woefully inadequate to maintain normal circulating concentrations of vitamin D in adults with minimal solar exposure that dermatologists recommended. Also new scientific evidence, including a study by the Centers for Disease Control and Prevention suggests that the DRI for vitamin D should be much higher to achieve adequate nutritional vitamin D status[30]. Maternal intake of 4000 IU/d increases maternal circulating concentrations to a degree that enough vitamin D enters the milk to produce significant effects on the infants’ circulating 25(OH)D concentrations[11], on the other hand, hypercalcinuria due to excessive vitamin D intakes is always accompanied by circulating vitamin D concentrations less than 100 ng/mL[12]. Since it has been shown that for every 1 µg (40 IU) of vitamin D intake, circulating 25(OH)D increases by 0.28 ng/mL over 5 mos on a given supplemental regimen, for circulating 25(OH) D concentrations that exceed 100 ng/mL, a daily vitamin D intake well in excess of 10000 IU/d (250 µg/d) for several months would be required[2]. So we can use vitamin D as supplementation and fortify foods without any concern.

Conclusion

According to the results, the consumption of progesterone-only contraceptives had no effect on the vitamin D levels of mothers' milk, although with regard to low levels of vitamin D in the milk of lactating mothers, it is necessary to enrich foods with vitamin D and for mothers to use vitamin D supplements.

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