Vitamin D Deficiency and Insufficiency in Orthodox and Non-Orthodox Jewish Mothers in Israel

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Abstract

Background: The modest clothing that Orthodox Jewish women wear exposes very little of their skin to sunlight. Under these conditions they may develop vitamin D deficiency, even in sunny Israel.

Objectives: To determine and compare the vitamin D nutritional status in Jewish orthodox mothers to that of non-orthodox mothers who live in the same metropolitan area in Israel.

Methods: 25-Hydroxyvitamin D was measured by competitive protein-binding radioassay in the sera of 341 Jewish Israeli mothers (156 orthodox and 185 non-orthodox). The sera were obtained 48–72 hours after childbirth during the late summer of 1998 and the spring of 1999.

Results: The mean (SD) serum concentration of 25-OHD was significantly ($P < 0.002$) lower (13.5 $\pm$ 7.5 ng/ml) in the orthodox than in the non-orthodox mothers (18.6 $\pm$ 9.6 ng/ml). Vitamin D deficiency (< 5 ng/ml) and insufficiency (< 10 ng/ml) were more common in the orthodox mothers (5.1% and 32.7% respectively) than in the non-orthodox mothers (2.7% and 13%, respectively). In subgroups of mothers supplemented with 400 units of vitamin D daily during pregnancy, vitamin D deficiency and insufficiency were less common (2.2% and 13%, respectively) in orthodox and non-orthodox mothers (0% and 8.1%, respectively). Vitamin D insufficiency was more common in the winter than in the summer only among non-orthodox mothers.

Conclusions: The high prevalence of vitamin D deficiency and insufficiency in Israeli mothers raises the question whether vitamin D supplements should be given to pregnant women in Israel, at least to orthodox mothers.

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25-Hydroxyvitamin D is the major circulating metabolite of vitamin D and is a precursor of the active dihydroxy metabolites, 1,25-dihydroxyvitamin D and 24,25-dihydroxyvitamin D. The serum half-life of 25-OHD is 2–3 weeks. Thus, measurement of its serum levels provides a sensitive index of vitamin D nutritional status. Serum 25-OHD levels are determined more by previous exposure of the skin to sunlight than by dietary intake of vitamin D. The season of the year, latitude, and dress (as required by custom or religious tradition that requires modesty) can dramatically affect the production of vitamin D in the skin and, subsequently, in serum 25-OHD levels [1–3]. Indeed, the seasonal differences between the highest and lowest monthly means of serum 25-OHD levels range from 10 to 20 mg/ml in various northern countries and may reach levels associated with osteomalacia in the winter and spring [4–6]. Even in a sunny country such as Israel, seasonal variations in 25-OHD serum levels were found in elderly people [7] and young mothers [8]. The dress code required by religious tradition in Asian immigrants in the United Kingdom [9] and in pregnant Pakistani women living in Norway whose clothing covered almost all of their skin caused low levels of serum 25-OHD and osteomalacia [10]. The aim of the present study was to compare the vitamin D status in Jewish orthodox mothers, whose modest dress code results in the exposure of very little of their skin to sunlight, to that of non-orthodox Jewish mothers who live in the same metropolitan area in Israel.

Methods

The concentration of 25-OHD was determined in sera obtained from 341 Jewish mothers 48–72 hours after childbirth. Two groups of maternal samples were studied. In one group (n = 185, mean age 30.7 $\pm$ 5.2 years, mean number of pregnancies 2.2 $\pm$ 0.5), sera were collected from non-orthodox mothers at the Lis Maternity Hospital, Tel Aviv, from March to May 1999 (n = 97) or during August and September 1998 (n = 88). In the other group (n = 156, mean age 27.4 $\pm$ 5.5 years, mean number of pregnancies 4.3 $\pm$ 2.9), sera were collected from orthodox mothers at the Ma'anei Hayeshua Hospital, Bnei Brak (n = 69 and 87, respectively, during the same time periods). Dietary vitamin D was less than 150 units daily in all women except for 37 non-orthodox mothers and 46 orthodox mothers who were receiving multivitamin supplements that contained 400 units of vitamin D daily during pregnancy. None of the mothers was receiving drugs known to alter vitamin D metabolism and none had malabsorption or hepatic or renal disease. Informed consent for participating in the study was obtained from all mothers.

25-OHD = 25-hydroxyvitamin D

Sera were separated and frozen at -20°C until assayed. The concentration of 25-OHD was measured by a competitive protein-binding radio assay after preparative sephadex LH-20 chromatography [11]. Serum calcium phosphorous and alkaline phosphatase levels were determined by a multichannel auto analyzer. Data were evaluated by the two-tailed, unpaired Student's *t*-test and by linear regression analysis.

Results

The mean (± SD) serum concentration of 25-OHD was significantly ($P < 0.002$) lower (13.5 ± 7.5 ng/ml) in the 156 Jewish orthodox mothers at 48–72 hours after delivery than in the 185 Jewish mothers of mixed non-orthodox populations (18.5 ± 9.6 ng/ml). Vitamin D deficiency (< 5 ng/ml) and insufficiency (< 10 ng/ml) were more common in orthodox mothers (5.1% and 32.7%, respectively) than in non-orthodox mothers (2.7% and 13.5%, respectively) [Figures 1 and 2]. In subgroups of orthodox and non-orthodox mothers supplemented with 400 units of vitamin D daily during pregnancy, vitamin D deficiency and insufficiency were less common in the orthodox (2.2% and 13%, respectively) and non-orthodox mothers (0% and 8.1%, respectively) [Figures 3 and 4].

No significant differences were found between the seasonal mean serum 25-OHD concentrations in both the non-orthodox and orthodox study populations. However, vitamin D insufficiency was more common in the winter than in the summer among the non-orthodox mothers [Figure 2]. The serum calcium (9.5 ± 0.2 mg/dl) and phosphorous (3.82 ± 0.56 mg/dl) concentrations and alkaline phosphatase activity (75.0 ± 35.8 units) in the non-orthodox women did not differ from those obtained in the orthodox women (9.2 ± 0.4 mg/dl, 3.51 0.71 mg/dl and 88.5 ± 33.9, respectively). No correlation was found between 25-OHD levels and serum calcium phosphorous or alkaline phosphatase values, nor between the serum 25-OHD levels and the number of previous pregnancies.

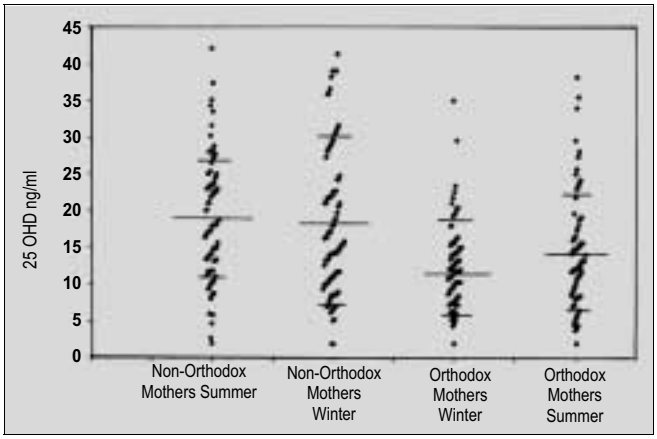

Figure 1. Serum 25-OHD concentrations in Israeli Jewish orthodox and non-orthodox mothers 48–72 hours after childbirth.

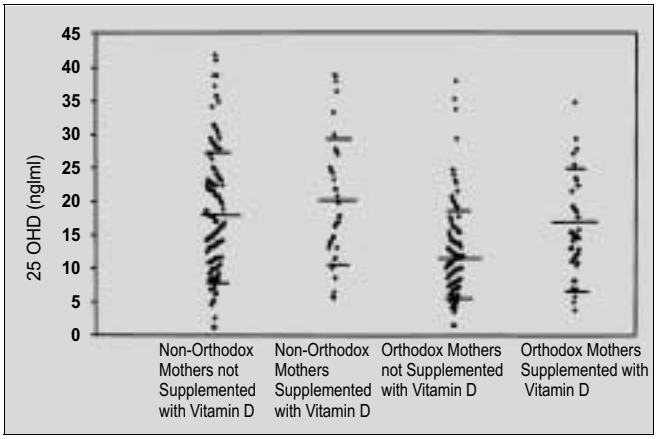

Figure 3. Serum 25-OHD concentrations in Israeli Jewish orthodox and non-orthodox mothers with and without vitamin D supplementation during pregnancy.

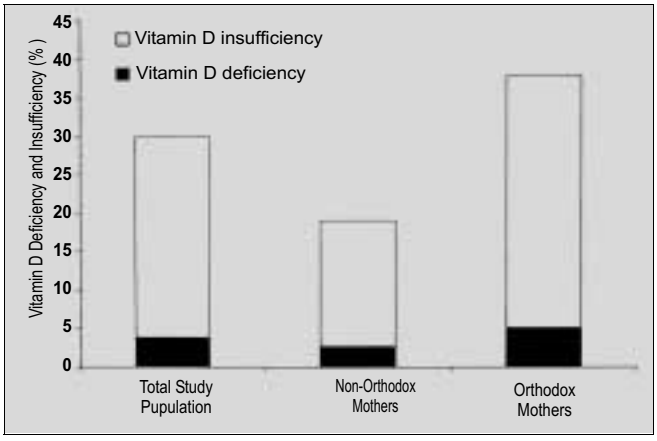

Figure 2. Vitamin D deficiency and insufficiency in orthodox and non-orthodox Jewish mothers.

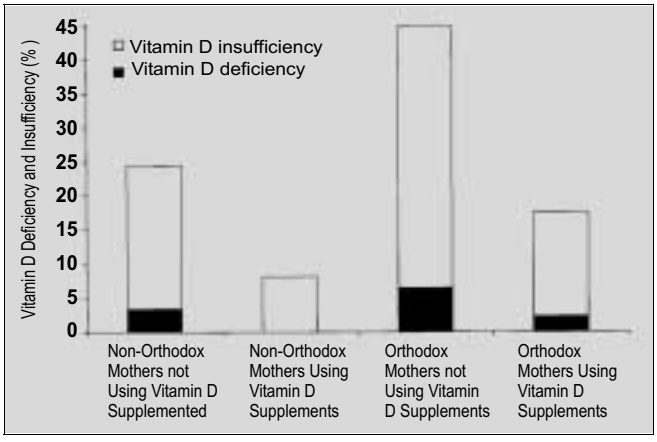

Figure 4. Vitamin D deficiency and insufficiency in Israeli Jewish orthodox and non-orthodox mothers with and without vitamin D supplementation during pregnancy.

Discussion

The skin is the organ responsible for the production of vitamin D_3. During exposure to ultraviolet light (spectral range 290–315 mm), 7-dehydrocholesterol is transformed to pre-vitamin D, which in turn undergoes a slow temperature-dependent isoimmunization into vitamin D_3. The effectiveness of sunlight depends on several factors, such as latitude, pollution, the amount of skin melanin pigmentation, which decreases the photosynthesis of vitamin D_3, and lastly exposure, which is restricted by certain populations' traditional strict dress code [1–3,12].

Vitamin D deficiency was historically considered to be rare in sunny countries. Nevertheless, studies that have emerged over the past two decades demonstrated that the prevalence of vitamin D deficiency is unexpectedly high in Israel among certain populations, such as elderly people [7,13–15] and young mothers and their newly born infants [8]. Since the orthodox and non-orthodox populations of this study live in the same metropolitan area, and since dietary behavior patterns contribute little to the nutritional status of vitamin D, we attribute the higher prevalence of vitamin D deficiency and insufficiency among the orthodox women to their modest dress code, which decreases exposure of the skin to sunlight.

There is a significant seasonal variation in serum 25-OHD in Western European countries [4–6]. The values of 25-OHD in serum samples obtained in the late summer and autumn are 10–20 mg/ml higher than those obtained during the winter and spring months. This is usually accounted for by seasonal changes in the ultraviolet energy of sunlight in northern latitudes. Seasonal variations in serum 25-OHD concentrations were also found in sunny Israel [7,8]. It is reasonable to assume that the lack of a significant seasonable variation in 25-OHD levels in the present study was because the winter of 1998–99 was unusually mild and the number of sunny days untypically high.

Little is known about the effect of maternal vitamin D status during pregnancy on the intrauterine growth and skeletal development of the human fetus. It is likely that vitamin D and 25-OHD – which pass through the placenta during the last trimester of gestation [16] – furnish the main vitamin D requirement of the newly born infant in its first months of life. This assumption is supported by the observation of a highly significant correlation between the concentration of 25-OHD in the mother's serum and that in the cord serum of her infant [16,17], and that vitamin D-deficient rickets in infants is associated with mothers whose diets were inadequate or with mothers who were exposed to little sunlight during pregnancy [18,19]. Moreover, human milk is a minor source of vitamin D [20]. These observations indicate that maternal stores of vitamin D and 25-OHD during late stages of pregnancy are the critical factor determining the infant's vitamin D nutritional status in the early months of life.

The results of the present study – a high prevalence of vitamin D deficiency and insufficiency in young women – raise the question whether vitamin D supplements should at least be given to orthodox pregnant women in Israel. These findings may be extrapolated to all populations that cover themselves with protective clothing for any reason and regardless of gender.

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