

## Comparative study of vitamin (D) Status in Full Term and Preterm Infants and Their Respective Mothers

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## Abstract

**Background:** Vitamin D is important for maintenance of calcium and phosphorus homeostasis and bone mineralization. Vitamin D deficiency in the mothers has possible adverse effects on the fetus and contributes to low vitamin D in infancy.

**Objectives:** To assess vitamin D status, calcium, phosphorus and alkaline phosphate in preterm infants and their mothers.

**Patients& Methods:** A cross sectional study was conducted on 46 neonates, and their mothers. The study was conducted between July and December 2013. The following had been done for all patients: Full medical history and Clinical examination for mothers and their neonates, Laboratory investigation: Maternal blood and Cord blood samples were collected at Delivery to measure vitamin D (vit. D), Calcium (Ca), phosphorus (P) and alkaline phosphates (ALP).

**Results:** Maternal hypovitaminosis D (vitamin D (25 (OH) D) < 10 ng \ mL was found in 89% of pregnant women at the time of delivery and neonatal hypovitaminosis D (vitamin D < 10 ng \ mL) was found in 93.5% of studied neonates. Maternal vit D did not correlate to maternal dietary vit D, but it correlated to cord blood vit D. Maternal vit D was correlated to cord blood vit D but not cord blood Ca, Phosphorus, or alkaline phosphatas.

**Conclusion:** Vitamin D levels in Egyptian mothers at delivery is deficient and it correlates well to cord blood Vitamin D levels.

**Key words:** vitamin D (25 (OH) D) deficiency, neonatal hypovitaminosis D, cord blood Ca, Phosphorus and alkaline phosphatas.

## دراسة مقارنة لحالة فيتامين (د) عند الأطفال كاملي النمو والأطفال الخدج والأمهات لكل منهما

**الخلفية:** ينظم فيتامين (د) تركيز الكالسيوم والفوسفات في الدم، وتعزيز النمو الصحي وإعادة تشكيل العظام، ولقد ثبت أيضا بعض الدراسات أن فيتامين (د) يلعب دورا هام في المناعة والمناعة الذاتية القطرية قد تلعب دورا في أمراض العظام الأيضية، والتي تعتبر مشكلة أكثر شيوعا في الخدج الرضع في البلدان المتقدمة والبلدان النامية والتي يمكن أن تؤدي إلى ضعف النمو الخطي على المدى الطويل. تشير البيانات الحديثة إلى أن وضع فيتامين (د) لدى الأمهات يؤثر على حالة العظام في مرحلة الطفولة. وأخيرا، نظرا لارتفاع معدل انتشار نقص فيتامين (د) في الأمهات عند الولادة وآثارها السلبية المحتملة على الجنين والمساهمة في انخفاض فيتامين (د) في مرحلة الطفولة، من المهم اعطاء نسب كافية للأمهات من مكملات فيتامين (د) أثناء الحمل كجزء من الاستراتيجيات للحفاظ على صحة الام والطفل.

**الاهداف:** دراسة وضع فيتامين (د) لدى الأمهات والأطفال حديثي الولادة، وتقييم عوامل الخطر المرتبطة بنقص فيتامين (د) في الأطفال حديثي الولادة.

**المنهجية:** تنتمي الدراسة للدراسة المقطعية، حيث تمت هذه الدراسة بعرف عمليات الولادة مستشفى النساء والولادة، واشتملت أطفال حديثي الولادة كاملي وناقصي العمر الرحمي. كل الأطفال حديثي الولادة خضعوا الى تاريخ مرضي تفصيلي، وتقييم العمر الرحمي باستخدام مقياس بالارد، والكشف الإكلينيكي الشامل، ووزن الطفل ومقارنته بالمعدلات الطبيعية لمتل هذا العمر الرحمي، وتاريخ مرضي للام، وفحوصات معملية للطفل والام (نسبة فيتامين د، الكالسيوم، الفوسفور، الكالين فوسفاتيز). وقد تم اخذ موافقة كتابية من الوالدين لإجراء البحث. تم وضع البيانات في الجدول وتحلل احصائيا بالبرنامج الإحصائي القياسي SPSS.

**النتائج:** قد وجد في هذه الدراسة ان ٨٩% من الامهات و٩٣% من الأطفال الخدج يعانون من نقص نسبة فيتامين د في الدم، وان نسبة كبيرة جدا من الامهات لا يتأولن فيتامين د قبل او أثناء فترة الحمل، وعدم وجود علاقة بين نسبة فيتامين د عند الامهات ونسبة الكالسيوم والفوسفور والكالين فوسفاتيز في الحبل السرى عند الاطفال، ووجود علاقة طردية بين نسبة فيتامين د في الامهات ونسبة فيتامين د في الحبل السرى للاطفال، ووجود علاقة طردية بين نسبة الكالسيوم في الامهات ونسبة الكالسيوم في الحبل السرى للاطفال، ووجود علاقة طردية بين نسبة الكالين فوسفاتيز في الحبل السرى للاطفال ونسبة الكالين فوسفاتيز الكالسيوم والفوسفور في الامهات.

**Introduction:**

Vitamin D is one of fat- soluble vitamins and it is responsible for intestinal absorption of calcium and phosphate.<sup>(1)</sup> Humans obtain vitamin D via synthesis from sun exposure and a small contribution from certain foods. The major determinants of vitamin D status are the characteristics of the skin and ultraviolet action over keratinocytes. Over the years, there is an increase in the prevalence of hypovitaminosis D.<sup>(2)</sup>

Vitamin D deficiency is recognized as a pandemic. The major cause of vitamin D deficiency is the lack of appreciation that sun exposure in moderation is the major source of vitamin D for most humans. Very few foods naturally contain vitamin D, and foods that are fortified with vitamin D are often inadequate to satisfy either a child's or an adult's vitamin D requirement. Vitamin D deficiency causes rickets in children and will precipitate and exacerbate osteopenia, osteoporosis, and fractures in adults.<sup>(3)</sup>

Maternal vitamin D status is responsible for fetal and newborn vitamin D status because a fetus receives all vitamin D support from the mother. Maternal 25 (OH) D readily crosses the placenta and as early as 24 weeks' gestation is metabolized to 1.25 (OH) 2D by the fetal kidneys for endocrine action and by other tissues for paracrine action.<sup>(4)</sup>

**Objective:**

The aim of the present study is to assess Vitamin D status, Calcium, Phosphorus and alkaline phosphate in preterm infants and their mothers.

**Subjects And Methods**

**Design of the study:**

A cross sectional study

**Subjects:**

The study was conducted on 46 neonates, and their mothers. The study was conducted between July and December 2013, consecutive deliveries was attended at the delivery room of EL Sahel Teaching Hospital.

1. Included neonates were further sub classified as follows:
  - ✦ Group A: less than 32 weeks and their mothers.
  - ✦ Group B: 32- 36 weeks and their mothers.
  - ✦ Group C: ≥ 37 weeks and their mothers.
2. Exclusion Criteria: Pregnant women with pre- existing parathyroid conditions, who required chronic diuretic or cardiac medication therapy including calcium channel blocker, or history of medications affecting metabolism of vitamin D and calcium. Congenital malformation, HIE.

**Methods:**

For all neonates the following were done: Full medical history and Clinical examination for mothers and their neonates.<sup>(2)</sup> Laboratory investigation: Maternal blood and Cord blood samples were collected at Delivery to measure vitamin D, calcium (Ca), phosphorus (P) and alkaline phosphates (ALP).

**Ethical consideration:**

Deliveries were attended and included after having a consent from the

mothers at the delivery room.

**Statistical Analysis:**

The data were coded, entered and processed on computer using Statistical Packaged for Social Science.<sup>(5)</sup> The level  $P \leq 0.05$  was considered the cut- off value for significance.

**Results:**

Maternal hypovitaminosis D (vitamin  $D < 10 \text{ ng} \setminus \text{mL}$ ) was found in 89% of pregnant women at time of delivery and neonatal hypovitaminosis D (vitamin  $D < 10 \text{ ng} \setminus \text{mL}$ ) was found in 93.5% of neonates. Maternal vit D did not correlate to maternal dietary vit D, but it correlated to cord blood vit D. Maternal vit D was correlated to cord blood vit D but not cord blood Ca, Phosphorus, alkaline phosphatase.

Table (1) Correlation between maternal vit D and other variables

Maternal Vit D	r	P Value
GA (W)	- 0.100	0.510
Birth Wt (Kg)	- 0.044	0.769
Antenatal Illness	0.082	0.588
Dietary Vit D	0.172	0.253
Sun Exposure	0.351	0.017
Vit D Supplementation	0.038	0.803
Neonatal Vit D	0.308	0.037*
Neonatal Ca	0.167	0.267
Neonatal P	0.034	0.822
Neonatal ALP	- 0.038	0.801

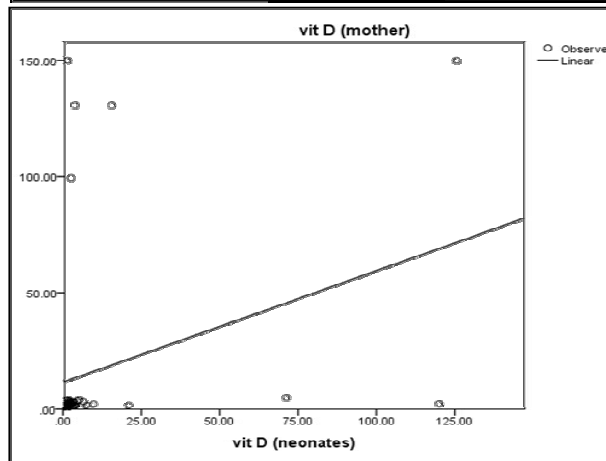


Figure (1) Positive correlation between Vit. D of mother and their neonates

Table (2) Correlation of lab findings between mother and their neonates

	R	P Value
Vit. D (ng/ml)	0.308	0.037*
Ca (mg/ml)	0.423	0.003**
Phosphorus (mg/ml)	0.391	0.007**
ALP (IU/ml)	0.433	0.003**

Table (3) Correlation between maternal symptoms of vit D deficiency and weight, GA of neonates and maternal age

Symptoms Of Vit D Deficiency	r	P Value
Birth Weight	- 0.114	0.449
GA	- 0.082	0.588
Gravidity	0.023	0.878
Parity	0.263	0.078
Maternal Age	0.045	0.766
Sun Exposure	- 0.274	0.066
Vit D Supp	- 0.028	0.854
Dietary Vit. D	- 0.088	0.559

R= Pearson Correlation

Table (4) Correlation between neonatal Ca and other Maternal variables

Neonatal Ca	r	P Value
Maternal Ca	0.423	0.003**
Sun Exposure	- 0.038	0.800
Vit D Supplementation	0.056	0.711
Dietary Vit D	- 0.077	0.609
Maternal Vit D	0.167	0.267
Maternal P	0.133	0.376
Maternal ALP	0.199	0.184

**Discussion:**

In the current study, maternal hypovitaminosis D (vitamin D ≤ 10 (ng\ mL (or 25 (nmol\ L)) was found in 89% of pregnant women at time of delivery and neonatal hypovitaminosis D (Vitamin D ≤ 10 (ng\ mL (or 25 (nmol\ L)) was found in 93.5% of neonates.

This is similar to Studies from Saudi Arabia, Kuwait, United Arab Emirates and Iran reveal that 10- 60% of mothers and 40- 80% of their neonates had undetectable to low vitamin D levels (0- 25nmol/L) at delivery.<sup>(6)</sup>

In the current study, maternal vit D did not correlate to maternal dietary intake of vit D, but it correlated to cord blood vit D. Delvin et al.<sup>(7)</sup> conducted a vitamin D supplementation trial with 34 French women who received minimal to no vitamin D from dietary sources. The supplement-treated women received 1000 IU/d vitamin D from the sixth month of gestation, whereas the other group served as a control group. Cord samples for the vitamin D- supplemented group demonstrated higher concentrations of both 25 (OH) D and 1.25 (OH) 2D. At day 4 of age, serum 25 (OH) D concentrations were higher in the vitamin D- supplemented group, compared with the control group.

Results of the present showed that none of mothers were supplemented probably with the recommended doses of vitamin D during pregnancy. Moreover, food fortification with vitamin D is not practiced in Egypt. Under these circumstances, exposure to sunlight becomes crucial for vitamin D acquisition. Although it seems odd that sunlight exposure is limited in this geographic setting, cultural practices including traditional clothing (Covered Dress) for women and limited access to open space for pregnant and nursing women were found to be the primary reasons for inadequate sunlight exposure, this may explain our results.

In this study, maternal vit D was correlated to cord blood vit D but not cord blood Ca, Phosphorus, alkaline phosphatas.

Nicholas et.al.<sup>(8)</sup> found a correlation between maternal and cord blood 25 (OH) D. Maternal vitamin D deficiency in pregnancy has been associated with neonatal hypocalcaemia.

This is agreement with a study that stated that it is generally accepted that maternal vitamin D status during pregnancy reflects the maternal and neonatal calcium homeostasis.<sup>(9)</sup> Several researches subsequently reported that infants of mothers with low vitamin D intake during pregnancy had low serum calcium concentrations in cord blood or during the first week of life. Also, it may be possible that maternal vitamin D status affects fetal growth and bone development.<sup>(10)</sup>

In conclusion, hypovitaminosis D is evident problem in Egyptian

mothers with associated low levels of cord blood vit D. A better antenatal care and higher vit D supplementation during pregnancy may be needed to improve maternal vit D status and consecutively neonatal status.

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