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# Relation Between Vitamin D Deficiency and Consequent Hypocalcemia with Pediatric Heart Failure

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## Abstract
There is no doubt that vitamin D is an important player in our day to day life, it has a variety of functions and benefits, in this report, a link between maternal and infantile vitamin D deficiency and different forms of pediatric heart problems have been established, data from multiple sources have been gathered, and each source studied this link from a different aspect, and the results were somewhat the same. The first source's objective was to review the prevalence of cardiomyopathy in pediatric cardiology in England and determine the prognosis, 16 subjects were studied, all with cardiac problems, and following biochemical evaluation, all of them were severely deficient in both Calcium and vitamin D. The second source stated that dilated cardiomyopathy and rickets were two of the first signs of vitamin D deficiency in infancy, which was dramatically relieved by vitamin D supplements. The third source established a link between maternal vitamin D deficiency and pediatric heart disease as a 2 months old female was admitted with congestive heart failure which was dramatically relieved by vitamin D supplements. The mother was found to be vitamin D deficient as well as the child.

## Introduction
Dilated cardiomyopathy (DCM) refers to congestive cardiac failure due to dilation and systolic dysfunction of the ventricles (predominantly the left ventricle). It is the most common form of heart muscle disease in children. Although many individuals with DCM have a familial (genetic) form, DCM can also result from various acquired myocardial insults or interactions of genetics and the environment, such as myocarditis, ingestion of alcohol and other toxic substances, and last but not least, childbirth (peripartum cardiomyopathy), which can occur late in pregnancy or several weeks to months postpartum.
Vitamin D is a fat soluble vitamin that can be obtained through three ways, from the diet, supplements and lastly, the most important source of vitamin D, which is the endogenous synthesis in the skin upon sunlight exposure. Vitamin D acts as a hormone and has a wide variety of important functions, the most important one being Calcium and Phosphate homeostasis, which is important in maintaining bone integrity, protecting children from rickets and adults from osteomalacia and osteoporosis.
Vitamin D has receptors on many cells, and it has been implicated in reducing inflammation, modulation of cell growth, neuromuscular and immune function. Vitamin D also have a role in regulating blood pressure in the kidneys, as well as blood sugar levels in the pancreas. A growing number of studies point to vitamin D deficiency as a risk factor for heart attacks, congestive heart failure, peripheral arterial disease (PAD), strokes, and the conditions associated with cardiovascular disease, such as high blood pressure and diabetes.
Dilated cardiomyopathy mostly has an idiopathic etiology or is caused by genetic inheritance or infection, can cause irreversible congestive heart failure. Hypocalcemia is a rare etiology of reversible dilated cardiomyopathy. Several studies have pointed toward the possible relation between maternal and infantile vitamin D deficiency and pediatric dilated cardiomyopathy.[1] **The aim of this report is to asses whether vitamin D deficiency indeed has a role in the development of congestive heart failure in infants.**

## Discussion
As previously mentioned, Vitamin D has a wide variety of functions, among those, it lowers the risk of cardiovascular diseases, and its deficiency have been well documented as an important risk factor of cardiovascular disease on multiple occasions, in this report however, we take a look at the relation between maternal and infantile vitamin D deficiency and the cardiac manifestations that follow.
**The First Study's** objective was to review the prevalence of this cardiomyopathy in pediatric cardiology units of southeast England and determine the prognosis. A retrospective review from 2000 to 2006 in southeast England. **Sixteen infants** (6 Indian, 10 black ethnicity) were identified: median (range) age at presentation was 5.3 months (3 weeks–8 months). All had been breast fed. **Six** had a cardiac arrest; **three** infants died. **Eight** were ventilated, **two** required mechanical circulatory support and **12** required intravenous inotropic support. **Two** were referred for cardiac transplantation. Median (range) of biochemical values on admission was: total calcium 1.5 (1.07–1.74) mmol/l; alkaline phosphatase 646 (340–1057) IU/l; 25-hydroxyvitamin D 18.5 (0–46) nmol/l (normal range >35) and parathyroid hormone 34.3 (8.9–102) pmol/l (normal range <6.1). They concluded that vitamin D deficiency and consequent hypocalcaemia are seen in association with severe and life-threatening infant heart failure. That no infant or mother was receiving the recommended vitamin supplementation highlights the need for adequate provision of vitamin D.[2]

**The Second Source** which is the Canadian Journal of Cardiology, in 1999 stated that DCM and rickets are two of the first signs of vitamin D deficiency in infancy. As a five-month-old boy presented with severe dilated cardiomyopathy, requiring intravenous inotropes as part of the initial management. He was found to have hypocalcemia due to vitamin D deficiency rickets. His cardiac function recovered completely after six months of vitamin D supplementation.[3]
**The Third Source** which is the Korean Society of Cardiology, in 2010, reported a case of a two-month-old girl with congestive heart failure who was diagnosed as having dilated cardiomyopathy secondary to hypocalcemia. After calcium and vitamin D replacement therapy, the patient showed a rapid reduction in hypocalcemic tetany and a rapid recovery of left ventricular function. The cause of the hypocalcemia was vitamin D deficient rickets. She was exclusively breast-fed as an infant, and her mother had a vitamin D deficiency and was diagnosed with osteomalacia. This confirms the risk of maternal vitamin D deficiency on the development of DCM in the infant. [4]

## Conclusion

As we move to the end of this report, we conclude that vitamin D is indeed an important and vital player in our day to day life, as it has many vital functions, it's deficiency can cause both short and long term complications. The soul purpose of this report is to turn an eye to this problem, and spread awareness since it can cause very serious complications. Most women in our (muslim) society, do not interact with the outdoors environment that often, especially women who wear "Nikab" on daily basis, they have a lower chance of sunlight exposure and an increase in the risk of vitamin D deficiency. Most women may complain of bony pain or other manifestations of vitamin D deficiency, however, others have silent vitamin D deficiency which is risky if it goes unnoticed, since it may cause complications to their offspring, among those vitamin D deficiency rickets and the consequent hypocalcemia and heart failure.

## Bibliography


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