Calcitriol in the human organism – Consequences of Vitamin D deficiency for the human health

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Introduction: My Bachelor thesis consisted of two major parts. Firstly, I covered the chemistry of Vitamin D with a bias on its biochemical function and the pathway of its biosynthesis. Secondly, studies were included into my work to emphasize the broad spectrum of functions, Vitamin D fulfills, as well as the etiology of Vitamin D deficiency.

Vitamin D deficiency is mainly caused by exogenous factors, i.e. circumstances of life. We use cars, lack on exercise and have a high calorie diet together with a low intake of essential micronutrients. Vitamin D cannot be produced endogenously in sufficient amounts.

Materials and methods, experimental design, other methodological information: The Vitamin D receptor recruits the so-called retinoid X receptor and forms a complex, which in turn binds to the Vitamin D-responsive element on the DNA-strand. This leads to a modification of the transcription rate of downstream genes and in return in down- or upregulated translation and protein synthesis. 1,25-dihydroxycholecalciferol tends to assemble calcium and phosphate in the bone, which is necessary for mineralization. In the pancreas, Vitamin D regulates the secretion of the hormone insulin.

1.1. 2010 a study by the Warwick Medical School evaluate the concentration of Vitamin D, by measuring 25-hydroxycholecalciferol. The validity of this study was based on the high sample number of 99745 people.

1.2. Another study, published in 2004, deals with the topic of depression and vitamin D deficiency. The effects of the doses on the biochemical functions and wellbeing were compared in a randomized study. The subjects got different doses of Vitamin D and the results were analyzed. The doses that were administered were within a range of 600 IU/d to 4000 IU/d.

1.3. A 2007 study deals with the topic of different types of cancer in post-menopausal women. They were split into three groups and got 1400-1500 mg per day, 1100 IU or a placebo.

1.4. In a study, 1760 women were divided into two groups, the first having a serum level of 52 ng/ml, the second of 13 ng/ml only.

1.5. Researchers calculated the relation between vitamin D deficiency and a testosterone defect. VDR knockout mice show a lower sperm production and activity as well as modified testis. The study design was a cross-section study, carried out on 2299 men. The testosterone level value was calculated via an immunassay.

1.6. Vitamin D fulfills an important role in patients with an end-stage heart insufficiency and that are waiting for transplantation. In a study 123 patients were administered 50 µg Vitamin D3 and 500 mg calcium per day or a placebo and 500 mg Calcium per day for 9 months. Biochemical parameters were recorded before and after the nine months. The survival rate was monitored during the following 15 months.
**Results and discussion:**

1.1. The study states, that at the highest level of 25-dihydroxycholecaliferol in serum there was a reduction of cardiometabolic disorders by 43%. High levels of vitamin D in middle-aged and elderly populations were associated with a decrease in cardiovascular disease, diabetes type two and metabolic syndrome.

1.2. The highest amount of 25-dihydroxycholecaliferol was measured during the summer months, were having a serum concentration of more than 40 nmol/l and a low parathormone level.

1.3. A daily intake of 1000 IU of 25-hydroxycholecalciferol per day reduces the risk to develop cancer by more than 75% in 1179 post-menopausal female participants over 55 years. The results show that a high Vitamin D status reduces the risk of various cancers in post-menopausal women.

1.4. Women with a higher concentration in the serum had a 50%lower chance of developing breast cancer. To reach a Vitamin D level that high, it was necessary to take 4000 IU per day. You would have to take 2000 IU a day and be exposed to UVB light for 12 minutes to reach a level of 52 ng/ml.

1.5. As a result only 262 men (11.4%) showed an adequate accommodation. 589 men had a deficit (25,6%). 457 men (19,9%) had a serious deficiency. 18% of the participants showed hypogonadismus. The seasonal variation of 25 -dihydroxycholecaliferol and testosterone was very noticeable. In august were 23,4µg/l and in march only 12,2µg/l. It is interesting that in northern countries the conception rate is very high in the summer months and that’s why the most birth rates are in spring.

1.6. Vitamin D is able to reduce pro-inflammatory cytokines that are involved in heart diseases and can help upregulating anti-inflammatory cytokines.

**Conclusion:** There is definitely a link between vitamin d deficiency and various diseases. Vitamin D receptors are everywhere in our body. This explains the various functions of this vitamin. Most people have a lack and this leads to serious consequences. The problem is, that in some studies the duration is very short, it is not significant enough and they don’t notice seasonal variability.

**References:**


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