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Correlation on Vitamin D and Pediatric Digestive Disorders

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Abstract

A cyclopentane polyhydrophenanthrene molecule known as vitamin D is primarily engaged in bone health and calcium metabolism, but it is also implicated in autophagy, gut microbiota regulation, cell proliferation, immune system activity and intestinal barrier integrity. Sunlight, dietary sources and vitamin D supplementation are all sources of vitamin D. Sunlight exposure causes the human epidermis to create vitamin D3, the most useful form of vitamin D. To convert vitamin D into its active form, 1,25-dihydroxyvitamin D, it must go through two hydroxylation events in the liver and kidney. Recent research has uncovered a wide range of intricate roles that contribute to the health of the gastrointestinal tract. Recently, it was suggested that vitamin D administration in addition to conventional eradication therapy might improve H. pylori eradication rates due to its antimicrobial action. Furthermore, it was proposed that low vitamin D levels may possibly have a role in the development of H. pylori infection. When there is a maternal vitamin D shortage, the detrimental effects of celiac disease may start even during foetal life. In addition to being connected with the histological findings of disease severity, vitamin D is also substantially correlated with the integrity of the gut barrier, which constitutes the core of the pathophysiology of celiac disease beginning. The role of vitamin D in maintaining lung function by reducing airway inflammation and inhibiting pathogen airway colonisation lends evidence to the link between this micronutrient and cystic fibrosis. Additionally, CF patients may get anticatabolic effects from this vitamin. Patients with inflammatory bowel disease also benefit significantly from adequate levels of circulating vitamin D, demonstrating the vitamin's role in both induction and remission in these patients. Vitamin D levels in these patients should be closely watched in order to prevent hypo- and hypervitaminosis, despite the fact that the findings addressing the connections between vitamin D, food allergies, diarrhoea and constipation are still debatable. To close the remaining gaps in our understanding of the complicated influence of vitamin D on gastrointestinal homeostasis, more research is necessary.

Keywords: Vitamin D • Gastrointestinal tract • Dietary sources

Introduction

Cholecalciferol (vitamin D2) and ergocalciferol are the two molecules that make up vitamin D, which is a member of the class of fat-soluble vitamins (vitamin D3). The skin's provitamin can be converted into cholecalciferol in the presence of ultraviolet B rays from the sun, or it can be received through diet by eating fish, mushrooms, dairy products, or certain supplements [1]. The first hydroxylation reaction takes place at the level of the liver, where vitamin D is transformed into 25(OH)D (25-hydroxyvitamin D), which is also the primary circulation form [2,3]. The second hydroxylation reaction takes place at the level of the kidneys, where vitamin D is further transformed into 25-(OH)2D (1,25-dihydroxyvitamin D), also known as calcitriol, the active form of the vitamin. The nuclear vitamin D receptor (VDR), which is expressed in a variety of tissues including the skin, adipocytes, small intestine, colon, parathyroid, etc., mediates the functions of calcitriol in the body. A heterodimer formed by the retinoic acid receptor (RXR) and the vitamin D receptor (VDR) interacts to the vitamin D response element (VDRE), which controls nuclear transcription. Numerous genes contain VDRE, which explains the role of the intestinal barrier, autophagy, gut microbiota modification, cell proliferation, immunological functions and other vitamin D-related processes. The most significant and well-established functions of vitamin D, however, continue to be the control of calcium homeostasis and regulation of bone health [4,5]. As a result, vitamin D is necessary for the growth of bone mass and bone mineralization.

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Description

The most crucial organ is the skin, which produces up to 90% of vitamin D as a result of exposure to ultraviolet B radiation from the sun. This process is influenced by factors like skin pigmentation, altitude, latitude, daily sun exposure timing, seasonality, atmospheric pollution, type of clothing, percentage of exposed skin and sunscreen use. Children definitely need less sun exposure than adults to make enough vitamin D for appropriate bone mineralization and development, as evidenced by their increased body surface-area-to-volume ratio and enhanced capacity to produce the vitamin. The majority of foods, including breast milk, have insufficient levels of vitamin D and are regarded as inadequate vitamin D sources. Thus, regardless of dietary practises, experts from all over the world concur that vitamin D supplements should be taken [6]. The Scientific Advisory Committee on Nutrition in the United Kingdom advises a safe vitamin D consumption of 340-400 IU/day for newborns, 400 IU/day for children between the ages of 1 and 4 and 400 IU/day for adults. The recommendations from the European Union are different, recommending that an intake of 600 IU/day for paediatric patients aged 1-17 years and 400 IU/day for newborns between 7 and 11 months may be adequate to stop future difficulties brought on by vitamin D deficiency. However, the European Academy of Pediatrics and the European Society for Pediatric Gastroenterology, Hepatology and Nutrition both state that the tolerable upper intake levels of vitamin D are 1000 IU/day for infants, 2000 IU/day for kids between the ages of 1 and 10 and 4000 IU/day for kids between the ages of 11 and 17.

Vitamin D and gastrointestinal disorders

It is not unexpected that vitamin D is involved in the emergence of gastrointestinal problems given the broad spectrum of immune-modulatory activities it possesses. Intestinal barrier dysfunction, mucosal injury and increased vulnerability to infectious agents have all been linked to vitamin D deficiency and have been shown to affect the formation and maintenance of

gut homeostasis. On the contrary, adequate vitamin D levels have been linked to junction complex integrity, hence preventing damage to the intestine.

Less research has been done on the connection between vitamin D and gastroesophageal reflux than on its impact on gastritis. As a result, a recent study that examined vitamin D levels and intake in kids with gastroesophageal reflux illness found that these kids had normal levels of vitamin D while having vitamin D intake levels below the daily recommended intake. Children's vitamin D levels and H. pylori-positive gastritis unquestionably have a strong correlation and vitamin D probably also affects other kinds of gastritis and even gastric reflux disease. To precisely identify this vitamin's significance in the pathogenesis of these illnesses, however, more research is needed.

Conclusion

Regarding the health of the gastrointestinal system, vitamin D is essential. Thus, new research suggests that vitamin D has many more multisystemic consequences beyond its traditional involvement in calcium metabolism and bone health. The antibacterial impact is quite helpful in speeding up the elimination of H. pylori. Studies on children's patients demonstrated that adding vitamin D supplements to regular H. pylori eradication protocols boosts eradication rates. The research in paediatric age groups regarding gastroesophageal reflux is still limited, however it appears that these kids still have normal levels of vitamin D despite their low intake. Additionally, at the level of the digestive tract, this advantageous micronutrient functions as an immunomodulator of both innate and adaptive immune responses. In terms of CD, vitamin D deficiency may not only contribute to the disease's onset but also worsen its clinical course. Therefore, early gut barrier disruption in vulnerable people and subsequent increased permeability brought on by vitamin D deficiency may be involved in the initiation of immunological reactions brought on by gluten. In genetically vulnerable kids, the early start of CD may also be related to the vitamin D status of the mother. Given that vitamin D has been shown to have antibacterial, modulatory and anticatabolic actions, its effects on CF are complex. Additionally, it has been demonstrated that low bone mineral density is significantly connected with vitamin D insufficiency in children with CF. In CF patients with compromised lung function, vitamin D may potentially play a role. The composition of the gut and lung microbiome may be improved in CF patients by vitamin D treatment by encouraging the growth of healthier intestinal and respiratory microorganisms. In individuals with inflammatory bowel disease, the impact of vitamin D in preserving the integrity of the gut barrier has been shown to be significant. Additionally, because to its immunomodulatory effects, this vitamin appears to lessen disease activity in these patients, minimising consequences from IBD. Vitamin D levels in children with ChD were found to be lower than those in children with UC. Vitamin D has been demonstrated to enhance the likelihood of developing food allergies in the paediatric population and to be lower in children with food allergies. Although the published results are still debatable, it was discovered that CMA newborns had lower vitamin D levels than controls. Children who have diarrhoea more often are known to have low vitamin D levels, according to a number of research conducted around the world; however, some authors could not find a connection between vitamin D status and diarrhoea risk. Recent research has demonstrated that vitamin D deficiency may raise the likelihood of chronic constipation and worsen its accompanying symptoms. Vitamin D has been connected to the development of intestinal motility dysfunctions. The specific systemic role of vitamin D should be defined, as well as the related "chicken versus egg" controversies, in future research with larger samples.

Acknowledgement

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Conflict of Interest

None.

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