A Method for Vitamin D Production

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Overview

Vitamin D is essential for health including the growth of bones, mental health, and functioning immune system, with vitamin D deficiency is associated with a number of health conditions. Since 20-80% of US, Canadian, and European populations are vitamin D deficient, it is recommended as a food supplement worldwide. The main forms of vitamin D supplements are D2 and D3. Vitamin D3, which is mainly produced by animal-source foods, was found to be more effective in raising vitamin D levels in the body. Therefore, there is a need for efficient methods to produce vitamin D for food supplements, preferentially from a vegan source. Prof. Segev and her team found that the microalga Emiliania huxleyi (E. huxleyi) can produce Vitamin D2 and D3. They identified the optimal cultivating conditions to produce a dry biomass that contains vitamin D and calcium that can be used as a nutritional supplement.

Background and Unmet Need

Vitamin D is a group of essential fat-soluble molecules important for the absorption and metabolism of calcium, magnesium, and phosphate, with additional biological functions, including inflammation reduction and cell growth regulation. Vitamin D deficiency can result in impaired bone mineralization and bone damage, which leads to bone-softening diseases, such as rickets in children and osteomalacia in adults.

The natural sources of vitamin D are relatively scarce. Moreover, the endogenous biosynthesis of vitamin D requires Ultra Violet B (UV-B) radiation by exposure to sunlight, which can also be a limiting factor. Therefore, vitamin D levels are often insufficient: Recent reports indicate 40% of Europeans and 24% of Americans are vitamin D deficient, and 13% of Europeans and 6% of Americans are severely deficient1. Therefore, vitamin D is a recommended food supplement worldwide. Vitamin D has two main forms in foods and dietary supplements: D2 (ergocalciferol) and D3 (cholecalciferol). Both forms are well absorbed in the small intestine. In general, vitamin D3 is found in animal-source foods (particularly fish, meat, egg, and dairy), and for supplements, it is typically produced from sheep wool lanolin. Vitamin D2 is found in fungi and is manufactured using UV irradiation of ergosterol in yeast. Several studies indicate that Vitamin D3 supplements are significantly more effective than Vitamin D2 in raising Vitamin D levels in the body2â€“4. Therefore, there is a need for efficient and sustainable production of Vitamin D (mainly D3), that has the added benefit of coming from a vegan source.

The Solution

Prof. Einat Segev and her team found that the microalga Emiliania huxleyi (E. huxleyi) can produce both Vitamin D2 and D3. They identified conditions to cultivate E. huxleyi and to produce a dry biomass that contains vitamin D and calcium that can be used as a source for food supplement production.

Technology Essence

The inventors found that the sterol synthesis pathway in the microalga, E. huxleyi leads to vitamin D3 production, which is known to be synthesized primarily in animals and is not common in plants or algae. The team showed that controlled UV-B radiation induces the production of vitamins D2 and D3 as well as other sterols. Moreover, they found that in the presence of bacteria (specifically, Phaeobacter inhibens), modifies the algae growth and vitamin D precursors. They developed a two-phase cultivating system in which E. huxleyi and the bacteria are separated by a barrier that allows fluid and solute communication between the E. huxleyi and bacteria. After cultivation, the algae biomass is dehydrated, containing vitamin D as well as other nutritional values (e.g., calcium).

Applications and Advantages

- A method to produce Vitamin D2 and D3 from algae (vegan friendly)
- A potentially more sustainable method of production
- Production of nutritional dry biomass of E. huxleyi with multiple nutritional benefits (vitamin D2, vitamin D3, calcium, and other sterols) for humans and animals.

Development Status

The team characterized the biological pathways for Vitamin D production in E. huxleyi, identified the growth conditions for vitamin D production, and designed a two-phase cultivating system.

References

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Patent Status

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