



## **Vitamin D3 in plants** effect of UVB exposure

**Jäpelt, Rie Bak; Silvestro, Daniele; Smedsgaard, Jørn; Jensen, Poul-Erik; Jakobsen, Jette**

*Publication date:*  
2012

*Document Version*  
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

*Citation (APA):*  
Jäpelt, R. B., Silvestro, D., Smedsgaard, J., Jensen, P-E., & Jakobsen, J. (2012). Vitamin D3 in plants: effect of UVB exposure. Poster session presented at 2nd International Vitamin Conference, Copenhagen, Denmark.

---

### **General rights**

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

## Poster: Vitamin D<sub>3</sub> in plants – effect of UVB exposure

Name: Rie Bak Jäpelt

Address: Technical University of Denmark, National Food Institute, Mørkhøj Bygade 19, 2860 Søborg, Denmark

Co-authors: Daniele Silvestro (b), Jørn Smedsgaard (a), Poul Erik Jensen (b), Jette Jakobsen (a). (a) Technical University of Denmark, National Food Institute, Mørkhøj Bygade 19, 2860 Søborg, Denmark, (b) VKR research centre “Pro-Active Plants”, Section for Molecular Plant Biology, Department of Plant Biology and Biotechnology, University of Copenhagen, Thorvaldsensvej 40, 1871 Frederiksberg, Denmark.

**Introduction:** As a surprise for many not only vitamin D<sub>2</sub>, but also vitamin D<sub>3</sub> can be found in plants. Vitamin D<sub>3</sub> is formed in the skin of vertebrates by exposure to UVB light (Fig. 1). The synthesis of vitamin D<sub>3</sub> in plants is on the other hand unresolved and contradicting results regarding the dependence of UVB-light has been presented (1,2,3). The aim of this study was, therefore, to investigate vitamin D<sub>3</sub> synthesis and metabolism in plants and how it changes upon UVB-exposure. Most work on vitamin D<sub>3</sub> in plants has been done with non-selective methods such as bioassays, but this study utilizes LC-MS/MS with derivatization to improve sensitivity and selectivity.

**Material:** Plants were grown in growth chambers with or without UVB light. Three *Solanaceous* species were used: *Solanum glaucophyllum* Desf. (waxy leaf nightshade), *Solanum lycopersicum* L. (tomato) and *Capsicum annuum* L. (pepper).

**Method:** The leaves were harvested, freeze-dried and saponified over-night. The vitamin D<sub>3</sub> metabolites were extracted from the non-saponified matter followed by solid phase clean-up. Further clean-up was performed with semi-preparative HPLC. Fractions of vitamin D<sub>3</sub>, 25-hydroxy vitamin D<sub>3</sub> and 1,25-dihydroxy vitamin D<sub>3</sub> were collected separately and derivatized with 4-Phenyl-1,2,4-triazoline-3,5-dione (PTAD) to increase sensitivity (Fig. 2). The derivatized extracts were subsequently analyzed by LC-ESI-MS/MS. The vitamin D<sub>3</sub> metabolites were quantified using their deuterated form as internal standard.

**Results:** Vitamin D<sub>3</sub> was identified in *S. glaucophyllum*, *S. lycopersicum* and *C. annuum* (1.7-200 ng/g dry wt.). The vitamin D<sub>3</sub> content in the UVB-exposed plants was 18-64 times higher than for the not UVB-exposed plants. 25-hydroxy vitamin D<sub>3</sub> was only identified in the UVB-exposed plants (0.5-31 ng/g dry wt.), whereas 1,25-dihydroxy vitamin D<sub>3</sub> only was found in UVB-exposed *S. glaucophyllum* (32 ng/g dry wt.).

**Conclusion:** It is remarkable that the leaves of the *Solanaceous* family contain high amounts of vitamin D<sub>3</sub> bearing in mind that the fruits from, e.g. tomato is an important food for humans. Thus, the potential of plants as a vitamin D<sub>3</sub> source exists. This study demonstrates that both UVB-dependent and independent pathways for biosynthesis of vitamin D<sub>3</sub> exist in plants.

**Acknowledgement:** We acknowledge The Danish Ministry of Food, Agriculture and Fisheries, Directorate for Food, Fisheries and Agri Business (3304-FVFP-07-774-02) and Technical University of Denmark for financial support. We would also like to thank Astrid Kvindebjerg for technical assistance.

## References

1. Curino, A., Skliar, M., & Boland, R. (1998). Identification of 7-dehydrocholesterol, vitamin D<sub>3</sub>, 25(OH)-vitamin D<sub>3</sub> and 1,25(OH)<sub>2</sub>-vitamin D<sub>3</sub> in *Solanum glaucophyllum* cultures grown in absence of light. *Biochimica et Biophysica Acta*, 1425(3), 485-492.
2. Björn, L. O., & Wang, T. (2001). Is provitamin D a UV-B receptor in plants? *Plant Ecology*, 154(1), 1-8.
3. Boland, R., Skliar, M., Curino, A., & Milanesi, L. (2003). Vitamin D compounds in plants. *Plant Science*, 164, 357-369.