

Response to Comment on: Sørensen et al. Maternal Serum Levels of 25-Hydroxy-Vitamin D During Pregnancy and Risk of Type 1 Diabetes in the Offspring. *Diabetes* 2012;61:175–178

Ingvild M. Sørensen,¹ Geir Joner,^{1,2} Peter A. Torjesen,³ and Lars C. Stene⁴

We appreciate the interest of Niinistö et al. (1) in our study on maternal serum levels of 25-hydroxy-vitamin D [25(OH)D] during pregnancy and risk of type 1 diabetes in the offspring (2). We analyzed 25(OH)D in serum samples from pregnant women mainly from the last trimester and found an association between lower maternal serum concentrations of 25(OH)D during pregnancy and increased risk of type 1 diabetes development in childhood. Niinistö et al. point out that intake of polyunsaturated n-3 fatty acids, as in cod liver oil, which is frequently used in Norway, may confound the observed association in our study.

This is a good point, but we did not have any information on supplement use or dietary intake in our cohort. As cod liver oil is a major source of the n-3 fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) in the Norwegian population, we have measured these and other fatty acids in the phospholipid fraction of the serum from the women in our study, albeit in a slightly smaller number (3). In this newly published study, we found no association between maternal levels of EPA or DHA during pregnancy and risk of type 1 diabetes in the offspring. Furthermore, the estimated odds ratio for association between 25(OH)D and risk of type 1 diabetes in children was essentially unaffected by adjustment for EPA, DHA, or both (unpublished results). As our samples were stored for a long time at -20°C , we cannot strictly exclude the possibility that degradation of the long-chain n-3 fatty acids has contributed to a dilution of an association.

Niinistö et al. (1) further refer to a study by Miettinen et al. (4) in which no association was found between maternal first trimester 25(OH)D and risk of type 1 diabetes in children. Whether the apparently inconsistent results are due to the differences between the studies, as discussed by

Niinistö et al., remains to be seen. We would like to point out that the comparison of 25(OH)D levels across studies using different assays should be done with caution. In a study by Hyppönen et al. (5), the assay used by Miettinen et al. (IDS OCTEIA) and the assay used in our study (DiaSorin radioimmunoassay [RIA]) were compared. They analyzed samples using both methods and found a mean difference of -15.7 nmol/L with IDS OCTEIA compared with the DiaSorin RIA. Furthermore, average differences up to about 20 nmol/L between the second and the third trimesters of pregnancy were recently reported by a Danish study (6).

ACKNOWLEDGMENTS

No potential conflicts of interest relevant to this article were reported.

REFERENCES

1. Niinistö S, Uusitalo L, Miettinen ME, Virtanen SM. Comment on: Sørensen et al. Maternal serum levels of 25-hydroxy-vitamin D during pregnancy and risk of type 1 diabetes in the offspring. *Diabetes* 2012;61:175–178 (Letter). *Diabetes* 2012;61:e8. DOI: 10.2337/db12-0220
2. Sørensen IM, Joner G, Jennum PA, Eskild A, Torjesen PA, Stene LC. Maternal serum levels of 25-hydroxy-vitamin D during pregnancy and risk of type 1 diabetes in the offspring. *Diabetes* 2012;61:175–178
3. Sørensen IM, Joner G, Jennum PA, Eskild A, Stene LC. Maternal fatty acid status during pregnancy and risk of type 1 diabetes in the offspring. *Diabetes Metab Res Rev*. 6 March 2012 [Epub ahead of print]
4. Miettinen ME, Reinert L, Kinnunen L, et al. Serum 25-hydroxyvitamin D level during early pregnancy and type 1 diabetes risk in the offspring. *Diabetologia*. 20 January 2012 [Epub ahead of print]
5. Hyppönen E, Turner S, Cumberland P, Power C, Gibb I. Serum 25-hydroxyvitamin D measurement in a large population survey with statistical harmonization of assay variation to an international standard. *J Clin Endocrinol Metab* 2007;92:4615–4622
6. Milman N, Hvas AM, Bergholt T. Vitamin D status during normal pregnancy and postpartum. A longitudinal study in 141 Danish women. *J Perinat Med*. 18 November 2011 [Epub ahead of print]

From the ¹Department of Pediatrics, Oslo University Hospital Ullevål, Oslo, Norway; the ²Department of Health Management and Health Economics, Institute of Health and Society, University of Oslo, Oslo, Norway; the ³Hormone Laboratory, Oslo University Hospital Aker, Oslo, Norway; and the ⁴Norwegian Institute of Public Health, Oslo, Norway.

Corresponding author: Ingvild M. Sørensen, i.m.sorensen@medisin.uio.no.
DOI: 10.2337/db12-0470

© 2012 by the American Diabetes Association. Readers may use this article as long as the work is properly cited, the use is educational and not for profit, and the work is not altered. See <http://creativecommons.org/licenses/by-nc-nd/3.0/> for details.