

Nonalcoholic Fatty Liver Disease and Abdominal Fat Accumulation According to Vitamin D Status in Patients with Type 2 Diabetes (J Obes Metab Syndr 2018;27:53-60)

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Received May 31, 2018
Reviewed June 7, 2018
Accepted June 18, 2018

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The association between vitamin D level and nonalcoholic fatty liver disease (NAFLD) has not yet been established. However, several studies suggest that vitamin D deficiency is associated with NAFLD and obesity and abdominal obesity.¹⁻³ Our study evaluated the association between NAFLD and abdominal fat accumulation according to vitamin D status in patients with type 2 diabetes. Ours is a clinic-based study showing that low vitamin D level is associated with NAFLD and abdominal visceral fat accumulation in Korean patients with type 2 diabetes, as reported in *Journal of Obesity & Metabolic Syndrome*.⁴

As a reader mentioned, the association between vitamin D level and visceral adiposity/prevalence of NAFLD could be influenced by the different treatments, and the contradicting findings observed in this study might be affected by antidiabetic medications, antihypertensive medications, and other drugs. Insulin resistance is a very important contributor to the pathogenesis of NAFLD. Therefore, we plan to analyze the effect on abdominal fat accumulation of each antidiabetic medication in future study including these participants.

The other question was about the effect of vitamin D level on the prevalence of NAFLD independent of visceral fat thickness in the logistic regression model. When we analyzed further as the reader mentioned, vitamin D deficiency was associated with the prevalence of NAFLD after adjusting for visceral fat thickness in addition to the given logistic regression model. Because vitamin D is known to be involved in immune regulation and inflammatory responses, low vitamin D is thought to play a role in the pathogenesis of NAFLD by hepatic inflammation through adipocytokines.⁵ We thank you for your very important comment on this and plan to evaluate whether visceral adiposity is an important factor in the association of vitamin D status with NAFLD in the next study. Because of the lack of data, outdoor activity, dietary habits, and seasonal variations in vitamin D were also not included in our study. This is a limitation of our current study.

Lastly, our finding showed that the vitamin D deficiency group has increased visceral fat accumulation compared with the vitamin D sufficient group. However, in our study, body mass index (BMI) was not statistically different among the three groups ($24.4 \pm$

4.0 kg/m² in the vitamin D deficient group, 24.8 ± 4.2 kg/m² in the vitamin D insufficient group, and 25.2 ± 3.8 kg/m² in the vitamin D sufficient group; *P* = 0.378). Unlike our study, several previous studies showed an inverse association between vitamin D level and BMI.^{6,7} However, another Korean study showed that vitamin D level is not correlated with BMI in men and is negatively correlated with visceral fat in both sexes, similar to our study.⁸ These inconsistencies may be due to race, nutrition status, and BMI in the patients. Recent studies have reported that vitamin D may affect glucose metabolism and adipose tissue distribution. I agree with the reports, but I plan to obtain more information such as physical activity, sun exposure, and nutrition status of participants to explain why the vitamin D deficiency group had increased visceral fat accumulation compared with the vitamin D sufficient group. I agree that further, large prospective studies are required to elucidate the associations between vitamin D level and NAFLD and abdominal fat. Finally, we thank you for the letter and giving us an opportunity to respond it.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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