

# Association of Body Mass Index and Fracture Risk Varied by Affected Bones in Patients with Diabetes: A Nationwide Cohort Study (*Diabetes Metab J* 2023;47:242-54)

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We appreciate the interest of Dr. So Young Park in our published article, “Association of body mass index and fracture risk varied by affected bones in patients with diabetes: a nationwide cohort study,” [1] and are grateful for the opportunity to further discuss our work. We agree with Dr. Park's comments on our study findings. Type 1 diabetes mellitus is linked to lower bone mineral density and increased risk of hip fracture [2,3], while the association between type 2 diabetes mellitus (T2DM) and hip fracture remains unclear. However, recent studies have suggested a relationship between T2DM and hip fracture, and one study has suggested that even prediabetic conditions may increase the risk of hip fracture [4].

Our study demonstrated that the impact of body mass index (BMI) on fracture varies by anatomical location [1]. Regarding our study's analysis of fracture risk according to BMI and affected skeletal sites, underweight individuals with T2DM had increased risk of total, vertebral, and hip fractures, while obesity and morbid obesity were associated with decreased risk of these fractures. Of note, hip fracture showed the largest change by BMI, and limb fracture was least affected.

Our subgroup analysis revealed higher risk of fracture in the

underweight group in men than in women, unlike other studies [4]. Our plausible explanation for the disparity in fracture risk by sex is that men have larger bones and less adipose tissue than women [5]. Since the weight of bone remains relatively constant compared to muscle or fat tissue, the effect of low BMI on fracture risk may be more significant in males. Dr. Park commented that this might explain the difference better by including body composition (bone, muscle, fat, and so on) in the analysis.

This study has the advantage of being the largest-scale nationwide population study conducted on patients with T2DM ( $n=2,086,187$ ) and a long follow-up period greater than 6 years. However, our study had limitations of a retrospective analysis using only National Health Insurance System claim data and did not consider important fracture risk factors, such as bone mineral density, history of falls, and drugs and diseases related to secondary osteoporosis.

Although being overweight may decrease the risk of fracture, it is not desirable due to its well-known association with T2DM [6]. On the other hand, being underweight may increase the risk of fracture. Thus, as noted by Dr. Park, our find-

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ings emphasize the importance of maintaining an appropriate weight through healthy diet and exercise habits. Further research considering other important fracture risk factors is needed.

Once more, we thank Dr. Park for her comprehensive review and valuable comments on our work.

## CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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