



# Vitamin D: missing link between hypertension and muscle mass

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We have read ‘Effects of calcium plus vitamin D supplementation on blood pressure: a systematic review and meta-analysis of randomised controlled trials’ and have shared our experiences with vitamin D and hypertension [1]. We retrospectively analysed data of 33 obese patients attending a structural educational programme at the Department of Endocrinology, Internal Medicine Clinic, University Hospital Centre Zagreb, Croatia. Two groups were included. Group 1: 16 patients with hypertension (3 males; 13 females; average body mass index (BMI), 38 kg/m<sup>2</sup>; median age, 40 years) and Group 2: 17 patients without hypertension (4 males; 13 females; average BMI, 45 kg/m<sup>2</sup>; median age, 45 years). Secondary causes of obesity were excluded (normal values of thyroid-stimulating hormone and cortisol after overnight suppression with 1 mg dexamethasone), and no participant took vitamin D supplements. Body composition was estimated by bioelectrical impedance analysis (fat percentage, fat mass, muscle mass and visceral fat rating). Statistical analysis was performed on the age, sex, BMI, body composition, glucose, lipid profile and vitamin D level. Both groups had low vitamin D levels. In Group 1, the median vitamin D level was 40 nmol/l (20–69) and in Group 2, it was 36 nmol/l (12–76). A two-sided *t*-test revealed no significant difference in vitamin D levels between the two groups (*P* = 0.343). In Group 1, vitamin D levels positively correlated with muscle mass (Spearman’s correlation coefficient, *r* = 0.68); however, this correlation was insignificant in Group 2 (*r* = –0.32). Whether this finding was accidental or some pathophysiological explanation existed, i.e., were there connectors linking vitamin D action, hypertension and muscle mass remains unknown.

Vitamin D influences muscles by the following pathways: (a) genetic, mediated by a receptor present in muscle cells and (b) nontranscriptional, which cannot be explained

by a slow genetic pathway. Vitamin D promotes mitogen-activated protein kinase (MAPK) signalling pathway activation, resulting in myogenesis initiation, cell proliferation, differentiation and apoptosis [2]. MAPK is activated by various stimuli, including angiotensin II [3]. MAPK signalling plays a bigger role in adipogenesis; after stimulation, transcriptional pathways are initiated to ensure terminal differentiation of precursors into adult white or brown adipocytes [4]. Vitamin D is associated with metabolic syndrome, hypertension and muscle mass, probably by MAPK signalling pathway. Postreceptor pathways mediated by vitamin D influence both metabolic syndrome and body composition elements (hypertension and muscle mass). For obese hypertensive patients, assessing only BMI is not enough because it does not reveal sarcopenic obesity. Hitherto, the type of patients with hypertension and low vitamin D level who would benefit from vitamin D substitution therapy has not been determined. In an analysis of 92 subjects with low baseline vitamin D levels (<79.9 nmol/l), significant decreases in 24-h systolic and diastolic blood pressures occurred during cholecalciferol supplementation [5]. Since our group of hypertensive obese patients had much lower baseline vitamin D levels, they should certainly be given substitution therapy. Further research is warranted to confirm the effect magnitude of calcium and vitamin D supplementation on blood pressure changes, as stated in the article published in your journal [1].

## Compliance with Ethical Standards

**Conflict of interest** The authors declare no conflict of interest.

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