



## Evaluation of the potential implications of following a vegan diet on bone health

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Cow's milk is the primary source of calcium in the NZ diet<sup>(1)</sup>. The absence of dietary planning in a vegan diet can result in the individual unknowingly obtaining low intakes of calcium. Prolonged low calcium intakes can result in negative implications on bone mineral density by increasing the risk of osteoporosis later in life. The measurement of bone health parameters in NZ vegan adults have not been investigated. Therefore, we measured bone mineral density, markers of calcium homeostasis and assessed intake of essential nutrients for optimal bone health in vegans. This cross-sectional study included adults (>18yrs), who followed a vegan diet for 2 years minimum. Demographic and lifestyle information was obtained from questionnaires including previous history of bone fractures and background of familial osteoporosis. A 4-day food record was completed for analysis of calcium, zinc, protein, magnesium, phosphorus and vitamin C intake and compared to the Estimated Average Requirement (EAR)<sup>(2)</sup>. Weight, height and BMI were obtained, bone mineral density was measured at the hip and spine via dual x-ray absorptiometry (DXA) and reported as Z and T scores. Plasma calcium concentrations were corrected for albumin. All values are presented as mean and standard deviation. The study included 212 participants, aged 39 ± 12.38 years, 71% female. T scores at the lumbar spine and femoral neck were -0.63 ± 1.22 (Z score: -0.29 ± 1.12) and -0.66 ± 1.00 (Z score: -0.24 ± 0.89), respectively. Nine participants had a Z-score of <-2.0 at the lumbar spine, and three at the femoral neck. Corrected calcium concentrations were 2.21 ± 0.33 mmol/L. Calcium intake was 917 ± 347.23 (range 195 to 2,429 mg/day) in all participants, which exceeded the EAR of 840 mg/day for adults aged 19-50 years. Men had higher intakes of calcium than women, 1,051 ± 363.7 mg/day (range 382 to 2,267 mg/day) vs. 867 ± 328.04 mg/day (range 194 to 2,428 mg/day), P-value <0.001. The main source of calcium in the vegan diet was tofu. The intake of protein (77 ± 27.80) g/day, magnesium (569 ± 181.05) mg/day, and vitamin C (145 ± 96.94) mg/day met the EAR, excluding vitamin and mineral supplements. However, the intake of phosphorus (1,472 ± 459.98) mg/day and zinc (10.6 ± 4.01) mg/day were below the EAR. The findings of this study suggest that bone health of vegans are not negatively affected by the exclusion of dairy in the diet, provided that appropriate dietary planning is included to avoid nutrient deficiencies associated with poor bone health. Despite mean intake of calcium exceeding the EAR, very low intakes demonstrated significant variations between participants.

**Keywords:** vegan diet; calcium; bone mineral density; adults

### Ethics Declaration

Yes

### Financial Support

Lottery Health Grant - LHR-2022-185693.

### References

1. Parnell W, Wilson N, Thomson C *et al.* (2011) A focus on nutrition: key findings of the 2008/09 New Zealand Adult Nutrition Survey. Ministry of Health: Wellington, New Zealand.
2. Nutrient Reference Values for Australia and New Zealand. Canberra: National Health and Medical Research Council; 2006.