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# **The relationship between nutritional adequacy and 24-month fracture occurrence in Māori and Non-Māori of advanced age.**

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A thesis presented in partial fulfilment of the requirements for the degree of Masters of Science in Nutrition and Dietetics.

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## Abstract

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### Background

The life expectancy of both Māori and non-Māori is continually increasing with more New Zealanders expected to live into advanced age. Adults over the age of 80 experience greater health loss than any other age group, with chronic disease and associated disability increasing substantially with age. Osteoporosis and the morbidity associated with fractures, particularly hip fracture, are of critical concern for an ageing population and may diminish quality of life and independence for older people, thus placing an increased burden on health and disability support services. The role of nutrition in the maintenance of bone mineral density (BMD), bone integrity, and subsequent fracture prevention, particularly in octogenarians is unclear. The ability to meet adequate energy requirements decrease with increasing age and may compromise intake of nutrients related to bone health. Nutrients necessary for bone health including: protein, calcium, vitamin D, phosphorous, magnesium and potassium are modifiable factors. Achieving optimal bone nutrient intakes may influence potential for maintenance of good bone health in adults of advanced age. This study aims firstly to investigate food and nutrient intakes of Māori and Non-Māori octogenarians to establish an understanding of nutrient adequacy. Secondly, to investigate the energy and nutrient intakes of participants who experience a fracture compared with those non-fractured to identify nutrient specific risk factors for fracture in adults of advanced age.

### Method

Comprehensive nutritional parameters were collected using two separate 24-hour multi-pass recalls. FOOD files were used to analyse food sources and nutrient intake. Face to face interviews were conducted to ascertain specific social, demographic, health and fracture information. Fracture occurrence was measured over a 24 month period following the 2 x 24-hour Multi Pass Recall's and included self-reported and hospitalised fracture occurrences. Hospitalisation data was obtained with permission from the participants. National Health Index New Zealand (NHI) numbers were used to identify fractures.

### Results

There were 317 participants (113 Māori and 204 non-Māori), aged 80-90 years in this study. For men and women respectively the median energy intakes were 6,943kJ vs. 5,603kJ for Māori; and 8,203kJ vs. 6,225kJ for non-Māori; protein as a percentage of energy was 15.5% vs. 15.9% for Māori and 15.7% vs. 15.5% for non-Māori. The top foods contributing to energy were bread, butter and margarine for all Maori and non-Maori with beef and veal contributed the most protein for Māori men, bread for

Māori women and milk for non-Māori, men and women. Compared to the Estimated Average Requirement (EAR) intakes of calcium, vitamin D, magnesium and potassium were inadequate for all participants. Compared to an EAR of 1100mg for men and women, median calcium intakes were low, 559mg vs. 539mg for Māori and 748mg vs. 672mg for non-Māori, men and women respectively. The primary food groups contributing to calcium were milk, cheese and bread. Compared to the EAR (15 µg/day in men and women) and vitamin D intake from food was low ( $\leq 4$  µg) for all participants. Compared to the EAR (350mg/day men and 265mg/day women), median magnesium intakes were 259 mg/day vs. 204mg/day for Māori and 271 mg/day vs. 238 mg/day for non-Māori, men and women respectively. The primary food groups contributing to magnesium were bread, breakfast cereals and fruit. A total of 18.6% of Māori and 20.6% of non-Māori sustained a fracture over a 24 month period. One in five Māori and non-Māori women sustained fractures. Among non-Māori women those who fractured were 1.1 times more likely to be financially insecure than non-fractured women ( $p=0.033$ ). For Māori women who were fractured, inability to afford to eat properly was 3.3 times more likely ( $p=0.012$ ), and previous fractures were 1.5 times ( $p=0.015$ ) more likely than for non-fractured women. Fractured Māori women consumed significantly less vitamin D (2.0µg vs 3.0µg) ( $P=0.01$ ) and magnesium (143.0mg vs 211mg) ( $P=0.033$ ) compared to non-fractured Māori women.

### **Conclusion**

Energy intakes were low for all participants and may have manifested the suboptimal intakes of calcium, vitamin D, potassium and magnesium prevalent in Māori and non-Māori, men and women. Fractures were more frequent in women than men, and both Māori and non-Māori sustained similar rates of fracture over the 24 month period. Magnesium and vitamin D intakes were significantly related to fracture occurrence in Māori women; this relationship diminished with further regression analysis. Increased intake of energy in adults of advanced age, with a focus on protein rich and nutrient dense foods, particularly calcium and magnesium, should be encouraged through consuming a variety of foods from the major food groups. Greater intakes of calcium can be achieved through higher consumption of milk and dairy products including yoghurt and cheese; and magnesium through increased green leafy vegetables, seafood, dairy, mushrooms, avocado, beans and bananas. Vitamin D intakes were minimal from food; however it is possible participants were receiving supplementary vitamin D and further investigation is warranted. For fractured Māori women, magnesium intake was significantly lower than those with no fractures. Promoting increased intakes of culturally acceptable foods such as vegetables and seafood may be advantageous to increase magnesium intakes.

**Key Words:**

Māori, non-Māori, fractures, nutrition adequacy, advanced age, protein, calcium, vitamin D, magnesium, potassium and previous fractures.

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## Abbreviations

<b>Abbreviation</b>	<b>Term</b>	<b>Abbreviation</b>	<b>Term</b>
<b>1,25 (OH)<sub>2</sub>D<sub>2</sub></b>	1a, 25-dihydroxyvitamin D <sub>a</sub> , of Calcitrol	<b>ERAS</b>	Enhanced Recovery After Surgery.
<b>25 (OH)D</b>	25 hydroxyvitamin D	<b>FFM</b>	Fat Free Mass
<b>25(OH)D D- 1-hydroxylase</b>	25- hydroxyvitamin D D-1 hydroxylase	<b>FM</b>	Fat Mass
<b>IU</b>	International units	<b>IFN-g</b>	Interferon Gamma
<b>kg</b>	Kilogram	<b>IGF- I</b>	Insulin-like Growth Factor
<b>L</b>	Litres	<b>IHD</b>	Ischemic Heart Disease
<b>µg</b>	Micrograms	<b>IL1</b>	Interleukin 1
<b>mg</b>	Milligrams	<b>IL6</b>	Interleukin 6
<b>ml</b>	Millilitres	<b>LM</b>	Lean Mass
<b>nmol/litres</b>	Nanomol per litre	<b>NHANES</b>	National Health and Nutrition Examination Survey
<b>AI</b>	Adequate intake	<b>NZANS</b>	New Zealand Adult Nutrition Survey
<b>AMDR</b>	Acceptable Macronutrient Distribution Range	<b>NZHS</b>	New Zealand Health Survey
<b>BMC</b>	Bone Mineral content	<b>OECD</b>	Economic Co-operation and Development
<b>BMD</b>	Bone mineral density	<b>PTH</b>	Parathyroid hormone
<b>BMI</b>	Body Mass Index	<b>QOL</b>	Quality of Life
<b>CDV</b>	Cardiovascular disease	<b>RR</b>	Relative Ratio
<b>DALY's</b>	Disability-adjusted life years.	<b>SD</b>	Standard Deviation
<b>DXA</b>	Dual energy X-ray absorptiometry	<b>TNFα</b>	Tumour Necrosis Factor alpha
<b>EAR</b>	Estimated Average Requirement	<b>eGFR</b>	Estimated Glomerular Filtration Rate

## Glossary

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<b>Term</b>	<b>Meaning</b>
<b>Hazardous Drinking</b>	Score eight or more on an Alcohol Use Disorders Identification test. A level considered to be detrimental to health.
<b>PHARMAC</b>	New Zealand government agency that decides which pharmaceuticals are to be publicly funded in New Zealand.
<b>Regular Physical Activity</b>	Participation in at least 30 minutes of exercise on five or more days of the week.
<b>Mana</b>	Prestige, authority, control, power, influence, status, spiritual power, charisma. <i>Mana</i> is a supernatural force in a person, place or object. <i>Mana</i> goes hand in hand with <i>tapu</i> , one affecting the other. The more prestigious the event, person or object, the more it is surrounded by <i>tapu</i> and <i>mana</i> .
<b>Octogenarian</b>	Adult aged between 80- 90 years.

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