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**Intakes, adequacy, food sources and biomarker status of
iron, folate, and vitamin B₁₂ in Māori and non-Māori
octogenarians: Life and Living in Advanced Age: A Cohort
Study in New Zealand (LiLACS NZ).**

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

Background: Iron, folate and vitamin B₁₂ are the three key nutrients associated with the development of anaemia and have also been associated with the dietary patterns linked to higher malnutrition risk in older adults. Octogenarians may be at increased risk for iron, folate and vitamin B₁₂ deficiency due to reduced food intake. Dietary factors, cooking methods, medications, presence of inflammation, and impaired gastrointestinal absorption may affect the availability and bioavailability of these nutrients. There are currently no specific nutrient reference values (NRVs) or biomarker cut-offs for adults in advanced age and little is known about the relationship between dietary intake and biomarkers for older adults.

Aim: To investigate the intake, adequacy, food sources and biomarker status of iron, folate and vitamin B₁₂ and the relationship between dietary intake and biomarkers.

Methods: In the follow up assessment of LiLACS NZ, 216 Māori and 362 non-Māori participants completed a detailed dietary assessment using 2x 24-hr multiple pass recalls. Adequacy of iron, folate and vitamin B₁₂ were determined by comparison to the Estimated Average Requirement (EAR) for adults aged 71+ years. Serum ferritin, serum iron, total iron binding capacity, transferrin saturation, red blood cell (RBC) folate, serum folate, serum vitamin B₁₂ and haemoglobin were compared to recognised cut-offs for adults. Generalised linear models and binary regression estimated the association between dietary intake and biomarkers.

Results: Most participants had adequate dietary iron intakes (88% Māori; 95% non-Māori above EAR) and biomarkers for iron (>94% above cut-offs). The EAR for vitamin B₁₂ was met by 74% Māori; 78% non-Māori and folate met by 42% Māori; 49% non-Māori. Māori versus non-Māori had higher intakes of vitamin B₁₂ (p=0.038) and serum vitamin B₁₂ (p=0.026). Increased dietary folate intake was associated with increased RBC folate for Māori (p=0.001) and non-Māori (p=0.014) and with increased serum folate for Māori (p<0.001). Folate intake >215µg/day was associated with reduced risk of deficiency in RBC folate for Māori (p=0.001).

Conclusions: Dietary intake and stores of iron are largely adequate in this population. Strategies to optimise the intake and bioavailability of foods rich in folate and vitamin B₁₂ may be beneficial.

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Abbreviations

AMDR	Acceptable Macronutrient Distribution Range
BMI	Body Mass Index
CVD	Cardiovascular Disease
DFE	Dietary Folate Equivalents
EAR	<i>Estimated Average Requirement</i> : A daily nutrient level estimated to meet the requirements of half the healthy individuals in a particular life stage and gender group
EI:BMR	Energy Intake: Basal Metabolic Rate
FFQ	Food Frequency Questionnaire
Hb	Haemoglobin
HoloTC	Holotranscobalamin
H2RA	Histamine-2 receptor antagonist
IDA	Iron Deficiency Anaemia
IHD	Ischaemic Heart Disease
LILACS NZ	Life and Living in Advanced Age: A Cohort Study in NZ
mg	Milligrams
MJ	Mega-joule
MMA	Methylmalonic acid
NHANES	National Health and Nutrition Examination Survey
NZANS	The New Zealand Adult Nutrition Survey
NZNNS	The New Zealand National Nutrition Survey
NRV	Nutrient Reference Value
NSAID	Non-Steroidal Anti-Inflammatory Drug
NZ Dep	<i>NZ Deprivation Index</i> : An index of socioeconomic deprivation in New Zealand
PHO	Primary Health Organisation
PPI	Proton Pump Inhibitor
RBC	Red Blood Cell
RDI	<i>Recommended Daily Intake</i> : The average daily dietary intake level that is sufficient to meet the nutrient requirements of nearly all healthy individuals in a particular life stage and gender group
SNP	Single Nucleotide Polymorphism
Tf-sat	Transferrin saturation
THF	Tetrahydrofolate
TIBC	Total Iron Binding Capacity
WHO	World Health Organisation
µg	Micrograms
µmol	Micromol
24-hr MPR	24-hour Multiple Pass Recall

Glossary

Whanaungataunga	Relationship, kinship, family connection
Kai	Food
Mana	Honour/prestige
Puha	New Zealand spinach
Hāngi	Food cooked in an earth oven (underground)
Boil-up	Traditional Māori food where vegetables and meat are boiled together in a stock pot
Kaimoana	Seafood
Hui	Gatherings
Octogenarian	Person aged between 80 and 90 years
Marae	A communal or sacred place that serves religious and social purposes