Associations between physical activity, body composition, nutrient intake, and bone mineral density in pre-menopausal Pacific Island women living in New Zealand.

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Abstract

Background/Aim: Anecdotally it is suggested that Pacific Island women have good bone mineral density (BMD); however little evidence for this or for associated factors exists. The aim of this study is to explore associations between several key predictors of bone health with bone mineral density, as measured by BMD (g/cm^2), in pre-menopausal Pacific Island women.

Methods: Healthy pre-menopausal Pacific Island women (*n*=91; age 16-45y) were recruited. Participants' body composition and total body BMD were assessed using DXA and air-displacement plethysmography (BodPod). A food frequency questionnaire (FFQ) and current bone-specific physical activity questionnaire (cBPAQ) were completed. Variables that significantly correlated with BMD were applied to a hierarchical multiple regression analysis.

Results: The mean BMD was 1.1 g/cm^2 ± 0.08. Bone-free, fat-free lean mass only (LMO, 52.4kg ± 6.9) and total mass (90.4kg ± 19) were the only factors to show a significant correlation with BMD. Body-fat (38.4% ± 7.6), cBPAQ score (1.7 (0.4,5.2)), and dietary calcium (1016mg ± 442), protein (18% ± 3.8) and vitamin C (125mg (94, 216)) showed no correlation with BMD. The regression analysis suggests that LMO is the most important predictor of BMD, explaining 13.4% of the variance, while total mass accounts for a further 2.5% of the variance. Together, these factors explain a total of 15.9% of the variability.

Conclusions: LMO is the strongest predictor of BMD, while many established contributors to bone health (calcium, physical activity, protein, and vitamin C) do not appear to be associated with BMD in this population. As just 15.9% of the variability can be explained, further research is needed in this area.

Key words: *Bone mineral density, Pacific Island, pre-menopausal, body composition, physical activity, dietary intake*

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List of Abbreviations

25-OH-D	25-hydroxycholecalciferol
AMDR	Acceptable Macronutrient Distribution Range
ASMM	Appendicular Skeletal Muscle Mass
BIA	Bioelectrical Impedance Analyser
BLHQ	Bone Loading History Questionnaire
BMAD	Bone Mineral Apparent Density
BMC	Bone Mineral Content
BMD	Bone Mineral Density
BMI	Body Mass Index
BMR	Basal Metabolic Rate
BPAQ	Bone-Specific Physical Activity Questionnaire
cBPAQ	current Bone-Specific Physical Activity Questionnaire
DXA	Dual-Energy X-ray Absorptiometry
EXPLORE	Examining Predictors Linking Obesity Related Elements
FFM	Fat Free Mass
FFQ	Food Frequency Questionnaire
IGF+1	Insulin-like Growth Factor
IL	Interleukin
LMO	Lean Mass Only
LRP	Lipoprotein Receptor Related Protein
MoH	Ministry of Health
MUHEC	Massey University Human Ethics Committee
NHANES	National Health and Nutrition Examination Survey
PAL	Physical Activity Level
PBM	Peak Bone Mass
pBPAQ	past Bone-Specific Physical Activity Questionnaire
PTH	Parathyroid Hormone
RANKL	Receptor Activator of Nuclear factor-Kappa B Ligand
RCT	Randomised Controlled Trial
RDI	Recommended Daily Intake
ROS	Reactive Oxygen Species
RPAQ	Regular Physical Activity Questionnaire
SD	Standard Deviation
SOP	Standard Operating Procedure
SPARC	Sport and Recreation New Zealand
tBPAQ	total Bone-Specific Physical Activity Questionnaire
UVB	Ultraviolet B
WHO	World Health Organisation

Contribution to Research

Table 1.1: *Contributions to this study*

Researchers	Contribution to this thesis
Maria Casale	Main researcher, participant recruitment, screening, and testing, data analysis, statistical analysis, interpretation and discussion of results.
Dr Pamela von Hurst	Main academic supervisor, DXA testing, and guidance with design of thesis, methods, statistical analysis, interpretation of results, and revision.
Dr Sarah Shultz	Academic supervisor and assistance with interpretation of physical activity measures, thesis design, interpretation of results, and revision.
Dr Marlena Kruger	Academic supervisor, assistance with design of thesis, methods, statistical analysis, interpretation of results, revision, and final approval.
Dr Rozanne Kruger	Principal Investigator of the Women's EXPLORE study, application for ethics, development of study design.
Wendy O'Brien and Shakeela Jayasinghe	Co-ordination of and participation in recruitment, screening, and testing of participants.
PC Tong	Analysis of DXA data and assistance with equipment for data collection.
Zara Houston, Richard Swift, Adrianna Hepburn, Jenna Schrijvers, Andrea Fenner, Sarah Philipsen, Owen Mugridge, Pamela von Hurst, Cath Conlon, Kathryn Beck, Rozanne Kruger	Participant screening, testing, and recruitment.
Jenna Schrijvers, Zara Houston, Chelsea Symons, Alex Lawn	Data entry of the FFQs