

What makes bones of Polynesian people stronger?

A Study of Polynesian People in Auckland, New Zealand

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PhD Project

Hypothesis

People of Polynesia have bone-forming cells, osteoblasts, which proliferate faster than those of Europeans. This is due to differences in their genetic makeup. Thus, Polynesians have stronger bones than Europeans

Scientists in the bone biology lab along with orthopaedic colleagues have become intrigued as to *what makes bones of Polynesian people stronger?* This project involving Polynesian people in Auckland is designed to investigate aspects of the phenotype of bone cells that might contribute to the development of stronger bones in Polynesians compared to Europeans in New Zealand.

Aim

To compare the fraction of cells in S-Phase in osteoblasts cultured from bone samples taken from Polynesian and European patients.

Background

Out of a population of approximately 4 million people in New Zealand, 7% are of Pacific Island origin. A large number of Pacific Islanders live in the Auckland region, making it the largest Polynesian city in the world. Clinicians, particularly orthopaedic surgeons, are astounded with the strength of bone (and other connective tissue) found in Polynesian people compared to Europeans in New Zealand. We have earlier demonstrated that Polynesians have a higher bone mineral density (BMD) than age- and weight-matched Europeans in New Zealand (Cundy *et al* J Bone Miner Res. 1995; Reid *et al* Br Med J 1986). Polynesian women had significantly greater BMD at all skeletal sites even after correcting for skeletal size ($p < 0.0001$). We have also shown that lean mass is higher in Polynesians (Reid *et al* Clin Endocrinol Metab 1990; Swinburn *et al* Int J Obes Relat Metab Disord 1996). In addition, we demonstrated substantially lower rates of hip fractures in Polynesians (Norton *et al* NZ Med J 1995), which is not accounted for by differences in hip axis length (Chin *et al* Osteoporos Int 1997). This suggests that higher BMD or other more subtle differences in morphology must account for the low hip fracture incidence in Polynesians. Therefore, there seems to be a true inter-racial difference in bone mineral density between Polynesians and Europeans studied in New Zealand, which is increased further by the greater body weight of Polynesians.

Method

- (i) Isolation of human osteoblasts. This is an established protocol in our laboratory where trabecular bone samples collected from consenting subjects undergoing joint replacement surgery are chopped up, collagenase digested to remove any marrow present then placed in culture flasks to allow osteoblast outgrowth cultures to form. Tissue samples will be collected from twenty Polynesian patients of each gender and control samples will be collected from a similar number of age- and sex-matched patients of European origin
- (ii) Fluorescence-activated cell sorting (FACS). Osteoblasts are grown to 50% confluency then fixed in 100% methanol, labelled with propidium iodide and sorted using a FACS machine. The modelling program ModFit LT is used to determine the proportion of cells in S-Phase.

Analysis

The fraction of osteoblasts in S-Phase from Polynesian bone will be compared to European bone to determine if there is any change in the rate of proliferation in the two groups.

Future Studies

RNA from these samples will be used to further study our hypothesis by investigating the regulatory mechanisms that determine the different proliferation rates of osteoblasts in the two ethnic populations.

Ethics Reference

Northern X Regional Ethics Committee NTX/05/06/058

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Awards

Best Paper Award, NZOA Registrar Meeting, 3-5 March 2011

J Bentley, U Bava, D Naot, K E Callon, RP Pitto, J Cornish. *Differences in In Vitro Proliferation Rates of Osteoblasts from Polynesian and European Patients.*

Collaboration

This PhD project is in collaboration with Professor J. Cornish and the Bone Research Group Laboratory, Department of Medicine, The University of Auckland.