The Effect of a High Calcium Dairy Based Supplement on Parameters of Bone Health in Pre-Pubertal New Zealand Children

A thesis presented in partial fulfilment of the requirements for the degree of Masters of Science in Nutritional Science

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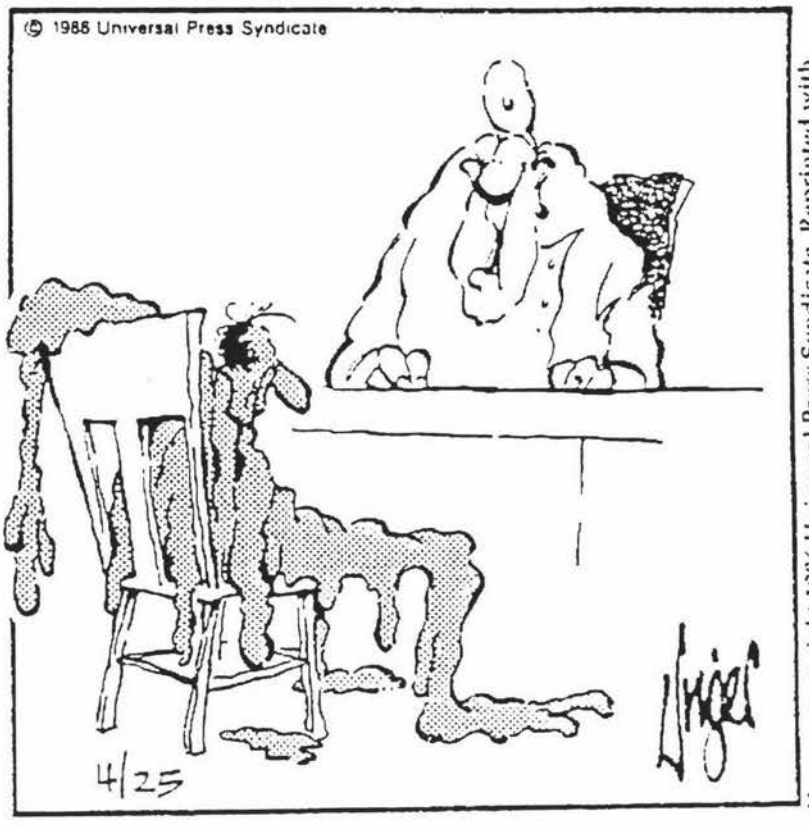

"You're not getting enough calcium."

Abstract

With an ageing population and an increased awareness of the rising health costs of fractures caused by osteoporosis (1); the focus of osteoporosis research is changing from treatment to prevention. More recent studies have looked at the effect of calcium supplementation during childhood and adolescence as a method of increasing the peak bone mass (2-10). It is postulated this will lead to a decrease in fractures in later life.

This study investigated the effect of a calcium enriched milk drink on bone density, bone mineral content and bone size in both male and female 8-10 year old New Zealand (NZ) pre-pubertal children.

One hundred and fifty four NZ pre-pubertal boys and girls were randomized to receive a high calcium dairy (Ca^{2+} =1200mg) drink or a control (Ca^{2+} =400mg) drink for 18 months. They were assessed at baseline and then every 6 months for the first 18 months, during the supplementation period; they were then followed up 12 months later. Bone mineral density, and bone mineral content was assessed at the total body, hip and spine. Indicators of bone size were measured at the spine. Anthropometric data was collected and Tanner stages of pubertal development, dietary calcium intake, compliance and medical questionnaires were administered. The calcium food frequency questionnaire was validated against a 3 day weighed food record at baseline.

There was no significant difference between the 2 groups for bone mineral density or bone mineral content observed either before or after the intervention. Trends were seen in bone mineral density in the total hip ($p=0.081$) and the trochanter ($p=0.088$). There was no difference in vertebral height or width at any stage of the study, indicating no additional influence on bone size. There were no significant differences between height, weight, lean mass or fat mass. Both groups had high habitual calcium intakes at baseline and this continued throughout the study, resulting in calcium intakes above the estimated calcium threshold for both groups.

In this 2½ year study (18 months supplementation, 1 year follow-up) there was no difference in bone mineral density in children aged 8-12 years. This is most likely due to a high habitual dietary calcium intake, that even with minimal addition of calcium to the diet a threshold level was reached where no further benefit was seen.

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List of Abbreviations Used

Abbreviation	*Full word(s)*	*Abbreviation*	*Full word(s)*
BMD	*Bone mineral density*	*PICP*	*Procollagen 1 carboxy-terminal propeptide*
DEXA	*Dual energy x-ray absorptiometry*	*HPro*	*Hydroxyproline*
PBM	*Peak bone mass*	*Pyr*	*Pyridinoline*
OA	*Oligo-amenorrhoeric*	*DPyr*	*Deoxypyridinoline*
EA	*Eumenorrhoeric*	*TRAP*	*Plasma tartrate-resistant acid phosphatase*
OCA	*Oral contraceptive users*	*Hyl*	*Hydroxylysine and glycosides*
PTH	*Parathyroid hormone*	*kJ*	*kilojoules*
BMC	*Bone mineral content*	*kcal*	*calories*
QCT	*Quantitative computed tomography*	*g*	*grams*
mg/d	*milligrams per day*	*µg*	*microgram*
mg	*milligrams*	*IU*	*International units*
%	*percent*	*mA*	*milliAmps*
RDI	*Recommended daily intake*	*kg*	*kilograms*
AI	*Adequate intake*	*mm*	*millimetres*
USA	*United States of America*	*n*	*number*
NZ	*New Zealand*	*SPSS*	*Statistical package for social sciences*
UL	*Tolerable upper intake level*	*SEM*	*Standard error of mean*
IGF-1	*Insulin-like growth factor-1*	*PRN*	*As often as required*
hr	*hour*	*NCHS*	*National children's health survey*
DASH	*Dietary approaches to stopping hypertension study*	*L1-L4*	*Lumber 1 to lumber 4*
$1,25(OH)_2D$	*1,25-dihydroxyvitain D*	*FMV*	*First morning volume*
FFQ	*Food frequency questionnaire*	*BAP*	*Bone alkaline phosphatase*
OC	*Osteocalcin*		