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A study of bone mass and bone loss in peri-menopausal Chinese women

Key Messages

1. Maintaining lean body mass during and after the menopausal transition helps prevent bone loss.
2. Weight-bearing physical activity helps maintain bone health and retard bone loss.
3. Adequate calcium intake helps maintain bone mineral density and bone mineral content.

Introduction

Two important predictors of osteoporotic fractures in later life are peak bone mass attained during young adulthood and the rate and level of bone loss seen during ageing, especially in menopausal women. Substantial bone loss during the peri-menopausal period increases a woman's risk of bone fracture in later life.

Aims and objectives

This study aimed to investigate: (1) the occurrence of bone change from the years (or months) immediately prior to menopause, through the peri-menopausal and early postmenopausal period; (2) how exposure to dietary, physical activity, and reproductive factors relates to bone mass and bone change in peri-menopausal women.

Methods

This study was conducted from September 1995 to September 1998. In order to include women immediately before, during, and after menopause, 438 women aged 45 to 55 years were recruited into this prospective study. Eligible women were identified from a telephone survey on women's health in mid-life (based on a randomised sample of telephone numbers from the residential telephone directory). Women using exogenous oestrogens, corticosteroids, and other medications known to affect bone loss, or those with a history of fracture, oophorectomy, or chronic conditions leading to secondary osteoporosis—including renal failure, malabsorption disorders, cancer, and metabolic bone disease—were excluded. Women were classified as being pre-, peri-, and post-menopausal according to pre-set criteria at baseline.

Bone mass, body composition, and lifestyle measurements were obtained at baseline. Further bone measurements were obtained at 9, 18, and 30 months. Lifestyle factors were ascertained using a previously validated questionnaire; bone mineral density (BMD) [g/cm^2], bone mineral content (BMC) [g], and body composition measurements were ascertained using a dual-energy X-ray densitometer.

Results

Cross-sectional correlates of bone mineral density/bone mineral content

Body measurements, including weight, lean mass, and fat mass, were correlated with baseline spine and neck of femur BMD (P<0.001) as well as total body BMC (r=0.3-0.7, P<0.001). Dietary calcium also weakly correlated with BMD/BMC (r=0.11-0.15, P<0.05). Age at menarche correlated negatively with BMD at the spine and neck of femur. Increasing time spent asleep or seated correlated negatively with neck of femur BMD, while vigorous activities such as climbing stairs correlated positively with neck of femur BMD. Grip strength, an indicator of physical fitness, correlated with total body BMC (r=0.2, P<0.001).

Bone changes

Of the 438 women recruited, 265 (61%) completed the 30-month follow-up study.

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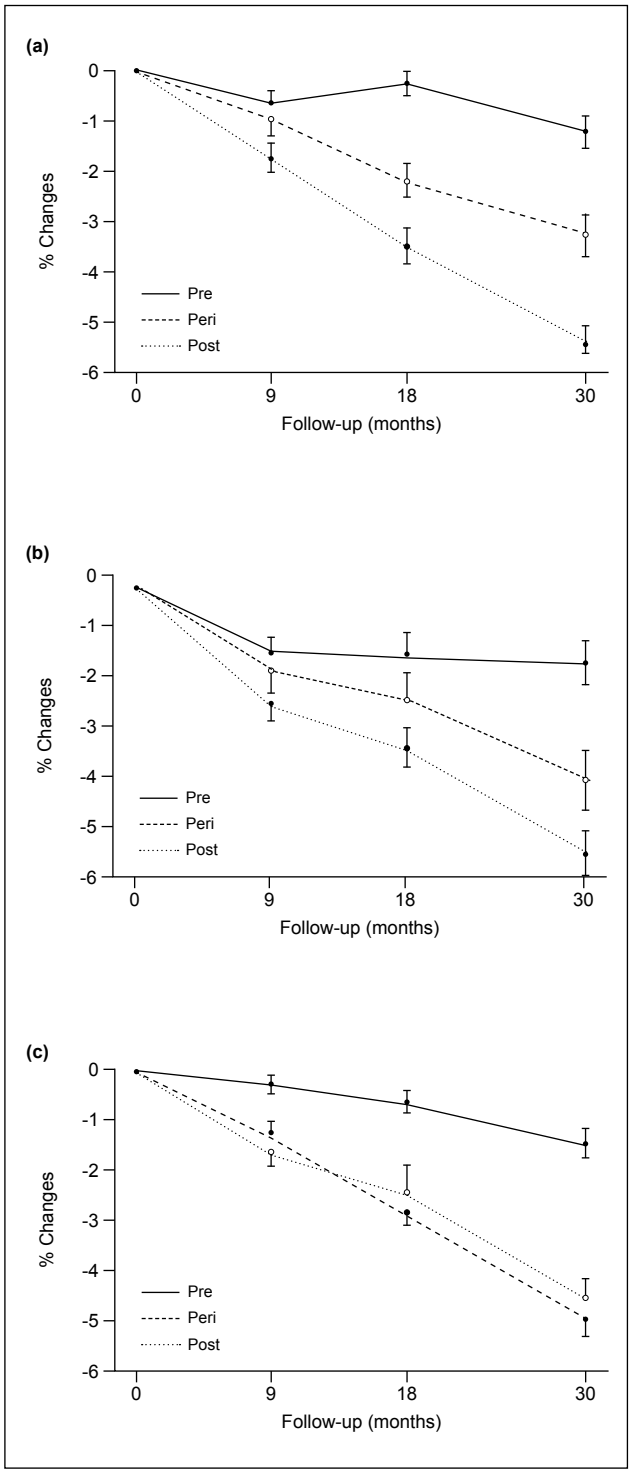

Fig. Percentage changes in bone mineral density (BMD) of the (a) spine and (b) neck of femur, and (c) total body bone mineral content (BMC) by menopausal status during the follow-up period
Bone loss began in the late premenopausal period and accelerated during the menopausal transition

The characteristics of these women were generally similar to those of the lost-to-follow-up subjects. Among subjects with follow-up data, 93 were premenopausal women, 104 proceeded through the menopausal transition, and 68 were postmenopausal throughout the follow-up.

Determinants of bone change

A stepwise multiple regression analysis was used to identify significant predictors of bone change. Regression coefficients derived from the baseline and follow-up BMD/BMC (9, 18, and 30 months) were the outcome variables. The independent variables included age, education, baseline lean body mass, regression coefficients derived from the four time measures, reproductive factors (age of menarche, number of pregnancies, duration of oral contraceptive use), dietary variables (calcium, soy protein, protein energy), and physical activities (number of hours spent on moderate activities, walking, walking with a load, stair climbing, and time spent in sleeping and sitting). Menopausal status was also included as a predictor; the results revealed that increasing age was associated with spinal bone loss (Fig). A positive regression slope of lean mass was protective of bone loss. Lean mass may be viewed as a marker of physical activity and fitness. Weight-bearing activities, such as walking, were associated with less whole body bone loss. Among dietary factors, high soy intake, a major source of isoflavonoid phytoestrogens, helped maintain total body BMC.

Discussion

Increasing age was associated with bone loss in premenopausal women. Bone loss began in late premenopause and accelerated as the menopause approached. The largest decline occurred during the menopausal transition. We have observed a longitudinal annual bone loss of about 0.5% during late premenopause, 2% during the menopausal transition, and 1.5% in early postmenopause (Fig).

Weight-bearing activities, such as walking and walking with a load, were associated with higher bone mass. These activities were also associated with the prevention of bone loss in our longitudinal observation.

Among dietary factors, dietary protein intake was negatively associated with bone loss in premenopausal women. Dietary calcium intake did not seem to play an important role in preventing bone loss in peri-menopausal women. Dietary soy intake had a positive association with total body BMC, particularly in late premenopausal women. Some data indicate that phytoestrogens play a positive role in bone health. Our findings indicate that in late premenopausal women, a high intake of soy helps maintain bone mass, particularly in premenopausal women.

As bone loss occurring during the peri-menopausal period increases the risk of fracture in later years, women should adopt preventive strategies during this period of life. Strategies that may help retard bone loss include maintaining

a lean body mass through exercise and physical activity, increasing the frequency and duration of weight-bearing activities such as walking and climbing stairs, maintaining adequate dietary intakes of calcium and perhaps increasing the intake of soy foods.

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