

Starting Early to Prevent Osteoporosis

It may seem unusual to conduct studies of children in a research center that focuses on studying the prevention and treatment of osteoporosis, a disorder most common in older people. However, it is well-established that childhood and adolescence are critical times for development of healthy bones that are resistant to osteoporotic fractures in older age. The years of skeletal growth provide a window of opportunity for maximizing bone strength since, during growth, bone mass and strength can increase dramatically. During these years, the skeleton is growing and adapting to changes in weight-bearing activities so that it is strong enough to support the physical activity of busy children. Furthermore, at the completion of growth the bones must be strong enough to meet the lifetime weight-bearing demands of adulthood. Once adult height is achieved, the skeleton is adapted for life as an adult, and little additional bone mass can be gained. Thus, bone healthy behaviors during childhood can decrease the risk of osteoporosis in old age. For that reason, researchers in the Creighton Osteoporosis Research Center have been conducting studies of bone health in children since 1992. Dr. Joan Lappe, whose research interest is health promotion and disease prevention, has taken the lead in these studies of children and adolescents.

Dr. Lappe's first study was conducted in rural children and adolescents in Saunders County NE. She enrolled 568 children and adolescents to determine whether an ultrasound device could be used to measure bone quality in young individuals. Ultrasound devices were somewhat portable and, therefore, could be taken to the schools. In addition, ultrasound involves no radiation exposure so these devices were promising for use in children. All of

the measurements were conducted in Saunders County schools. Many of the children were measured again two and three years after the original study. These studies found that ultrasound was indeed a valuable tool for assessing bone health in children. Some of the readers of

this newsletter may have been involved in these early studies.

In another group of Saunders County children, Dr. Lappe assessed the relationship between ultrasound values and physical activity in third and fourth graders. An interesting finding in that study was that overall physical activity in rural children was very low, and, furthermore, there

was no difference between hours of activity during school hours compared to after school. Indeed, the television and computer had trumped running around outdoors, even in rural children.

In 1998, Dr. Lappe and her team worked with a Danish company to evaluate a new ultrasound device in 469 healthy children and adolescents years in the Omaha area. This new device was easier to use than the original ultrasound, and it was capable of measuring even little 6-year-olds. Ultrasound measurements are still used today to evaluate bone health of children and adolescents, especially in research studies. However, for clinical purposes DXA bone scans are preferred.

In 1997 and 1998 we started two studies with 199 nine-year-old girls to determine the effects of increasing dietary calcium and physical activity on increases in bone mass. Some of the girls were randomly assigned to increase their dietary calcium intake and/or physical activity, while others were randomly assigned to continue with their usual diet and activity. We recently completed those two studies after 11 years! The study nurses, Gina Lypaczewski and



Julie Stubby, did a great job of working with the young participants and, as a result, about 77% of the girls finished the studies. We currently are in the process of analyzing the data. During this study we found that young girls who start drinking milk and eating dairy foods seem to develop the habit of doing so, which is a very healthy habit.

We did have an interesting incidental finding from the two longitudinal studies. After seven years of study, girls with the highest calcium intake had not gained more weight than the girls with the lowest calcium intake, even though the “high calcium” girls consumed an average 434 calories per day more than the “low calcium” group. These findings suggest that optimal calcium in the diet may decrease weight gain in young girls. Other studies in adults have reported that calcium, particularly from dairy food, may help to maintain weight. The girls who consumed the calcium-rich diets also significantly increased their intake of essential nutrients compared to girls on their usual diets.

We decided that we wanted to learn more about the effects of dairy food on weight, so Dr. Lappe submitted a grant application to the National Institutes of Health (NIH). Her grant was funded recently for \$2.3 million, and now she and her team, led by Margaret Begley, are studying the effects of dairy food on increase in body fat in 13- and 14-year-old girls. (Anyone interested in learning more about this one-year study should call 402-280-4070).

In 2001, we were awarded a contract from the National Institute of Child Health and Human Development to participate in a multi-center study to establish a normative data base of bone mass measured by DXA in children. The study was needed because doctors recognized that it was important to assess bone health of children who had illnesses that could affect their bone

growth and development. However, reference data were not available with which doctors could compare the DXA measurements of their sick children to healthy children of the same age and stage of development. Thus, we became one of five centers in the US to participate in the study. The other centers included: The Children’s Hospital of Philadelphia; Los Angeles Children’s Hospital; Cincinnati Children’s Health and Medical Center; Columbia University; and Children’s Hospital Philadelphia. The study is a multi-ethnic study of over 2,000 children and adolescents who have undergone annual DXA measurements for 3 to 7 years, along with assessment of growth, puberty status, dietary intake, physical activity and skeletal maturation. We enrolled more than 400 children at our center and they are being followed by our nurses, Gina Lypaczewski and Chris Von Buettner. Findings from this study are already helping doctors to evaluate bone development in their patients. Once the study is completed, the findings will provide more valuable information such the importance of dietary calcium and physical activity at specific ages for bone development, the effect of late puberty on bone mass accrual, etc. We feel very fortunate to be a part of this valuable research study.

Thus, over the course of the last 16 years in the Creighton University Osteoporosis Research Center, we have continuously been conducting pediatric studies. Most of them have been funded by the National Institutes of Health. More than 2000 children and adolescents have participated in these studies. We greatly appreciate the dedication of these young people and their parents in helping us prevent osteoporosis in future generations of older people.

The Superman Pose!

Positioning small children for a forearm bone density scan can be quite the challenge! Lead technologist Jennifer Larsen, R.T. (R) (BD) (ARRT), CDT has developed a method which has affectionately been called “The Superman Pose”.

In 1998 when we first began scanning nine year old girls we had to become very creative to get the forearm scans. At that age the girls were big enough to sit on a parent’s lap so that we could get an accurate forearm scan. In 2002 we started scanning children who were as young as age 5 and they were much more of a challenge to position. Eventually we had them lie on their abdomen and stretch out both arms like Superman. Hence the Superman pose was created for forearm scanning.



Bone Health Begins in Childhood

Perhaps the word ‘osteoporosis’ conjures an image of elderly men and women who have weak bones that break easily. In truth, Charles E. Dent (1972) stated that “senile osteoporosis is a pediatric disease”. In other words, an adult’s risk of developing osteoporosis later in life is determined by his or her bone gain during childhood.

Peak bone mass is defined as the maximum amount of bone tissue achieved during skeletal growth. The majority of bone mass is achieved during the first two decades of life, with significant growth spurts occurring during adolescence. By age 18, skeletal growth is nearly complete, with minor accumulations in bone density occurring until about age 30. After the age of 30 slow bone loss starts to occur, especially in the hip. For women, this bone loss is accelerated from about two years before the last menstrual period until about four years after the last menses. In

the case of men, they have larger bones and their bone loss starts later in life and progresses more slowly than that of women. While men do not experience the rapid bone loss that affects women, declining testosterone levels may cause similar bone loss as that resulting from postmenopausal estrogen loss.

Because individuals who achieve good peak bone mass are at reduced risk for osteoporosis later in life, it is important to focus on factors, both genetic and environmental, that affect peak bone mass. Gender, race, and family history are genetic influences. Peak bone mass tends to be higher in men than in women. African-American females tend to achieve higher peak bone mass than Caucasian females. Individuals with a family history of diagnosis of osteoporosis or non-traumatic fractures, especially maternal hip fractures, tend to have a lower peak bone mass and are, therefore, at increased risk for osteoporosis.

Although one cannot change genetic factors, there are environmental and lifestyle considerations which can be modified in order to achieve peak bone mass:

CALCIUM deficiency in young people can account for 5-10 percent lower peak bone mass and can significantly increase a person's risk for hip fracture in later life. (See next article on dietary recommendations.)

VITAMIN D helps the body absorb calcium. The American Academy of Pediatrics recommends that children (from newborns to teens) get 400 International Units (IU) of vitamin D per day; this is double the previously suggested dosage and is based on the most recent research. Cottage cheese and other dairy products

do not naturally contain vitamin D, but most commercially-purchased milk is fortified. However, most children and teens do not currently drink enough milk to meet the new daily requirements. Vitamin D is sold in drops, capsules and tablets. The label should read either Vitamin D3 or cholecalciferol. The very best source of vitamin D is sunlight because the body makes vitamin D when sunlight hits the skin. Too much exposure to sunlight can increase the risk of skin cancer and premature aging of the skin. Thus, it is recommended that 15-30 minutes of sunlight exposure between 10am and 3pm without sunscreen is adequate for maintaining Vitamin D levels in most individuals. In the United States, in the northern climate, no Vitamin D is obtained during the winter months due to the angle of the sun. During these months, Vitamin D supplementation is recommended.

PHYSICAL ACTIVITY in childhood and adolescence is associated with greater bone mineral density. Weight-bearing activities such as running, walking, jogging, skipping rope, and playing soccer are excellent activities which help to build strong, healthy bones.

A HEALTHY LIFESTYLE that eliminates smoking (very high connection between smoking and osteoporosis) and excessive alcohol consumption will have a positive influence on peak bone mass.

** adapted from the NOF Strategies for Osteoporosis: Peak Bone Mass; recent research conducted in the Osteoporosis Research Center and elsewhere.*

Do Your Bones a Favor with Dairy Foods

by Jennifer Meyer, RD Dairy Council of NE

Bone health and osteoporosis prevention is a topic that is usually not on the minds of children and teens. Although osteoporosis typically affects older individuals, taking action to help avoid this disease must begin during the younger years. Just as being physically active and eating right are important for general health, they are also key to keeping our bones healthy.

A number of studies have shown that consuming an adequate amount of calcium is key to building peak bone mass and preventing osteoporosis and fractures later in life. Dietary calcium recommendations are 800 mg/day for children ages 4 to 8 years and 1,300 mg/day for those 9 to 18 years. Unfortunately, most children and teens older than age 8 fall short on meeting calcium recommendations.

Dairy foods like milk, cheese, and yogurt are well-known sources of calcium, but they also deliver other important bone building nutrients such as vitamin D (if fortified), phosphorus, potassium, protein, magnesium and zinc. In fact, the American Academy of Pediatrics calls dairy foods "preferred" sources of calcium compared to supplements and other foods.

According to the National Dairy Council, half of children ages 2 through 8 and three-quarters of children ages 9 through 19 don't get the recommended daily amount of milk or milk products. The 2005 Dietary Guidelines

recommend that all children ages 2 through 8 years should eat at least two cups a day of low-fat or fat-free milk or milk products and three cups a day once they turn 9.

Bone Building Tips For Parents:

- 1) **Kick the Can-** Serve milk with meals instead of soft drinks. For variety, try flavored milk which provides the same nutrients found in white milk.
- 2) **Mix it with Milk-** Make hot cocoa, soup and oatmeal with milk instead of water.
- 3) **Cheese Please-** Add a slice of cheese to your child's favorite sandwich or sprinkle shredded cheese over salads and casseroles.
- 4) **Dress it up with Dip-** Make fruit and vegetables more tasty with dips made from yogurt.
- 5) **Break for Breakfast-** For breakfast let your children make a yogurt parfait with his or her favorite flavor of yogurt topped with fruit and granola.
- 6) **Snack Smart-** Have string cheese on hand for a quick snack.
- 7) **Be a good Role Model-** Children learn good nutrition from their parents and other role models, so if they see you drinking milk, they will be more likely to choose it, too.

For great dairy recipes and more information on the importance of dairy in a healthy diet, visit www.nebmilk.org.

Opportunities to Participate

The Creighton University Osteoporosis Research Center is conducting the following studies. If you have any questions, please call 402-280-BONE (280-2663) or Toll-free 1-800-368-5097.

HAVE YOU OR SOMEONE YOU KNOW EXPERIENCED A BROKEN BONE?

The Osteoporosis Research Center is currently conducting a research study investigating the underlying causes of osteoporosis in postmenopausal women.

Do you meet the following criteria?

- Age 45-70
- At least four years since last menstrual period
- Not currently on treatment for osteoporosis

The broken bone occurred during the last five years and was not a result of an auto accident.

GENETIC DETERMINATIONS

The purpose of this study is to identify genes and proteins that may increase the risk of osteoporosis

- Seeking Caucasian women age 50-55
- Free bone density scan (DXA) with interpretation of results for eligible participants
- Stipend available; just 2 visits

ARE YOU DIABETIC?

The Creighton University Osteoporosis Research Center is currently conducting a study to determine the effects of diabetes on bone health.

Both men & women are eligible for this study. To qualify for participation:

- You must be a type 1 diabetic for at least 3 years.
- You must be between 19 and 50 years of age.
- 3 visits to our center
- 1st visit involves a blood draw and bone density scans.
- Monetary compensation for study visits

ARE YOU A POSTMENOPAUSAL WOMAN WHO HAS OR MAY HAVE OSTEOPOROSIS?

You may qualify, if you are: A female age 45 to 85 and at least 2 years postmenopausal.

Eligible participants will receive

- Study medication/calcium and vitamin D supplements
- Study related physical exam and procedures
- Modest compensation for study visits

BONE QUALITY STUDY

Seeking women age 40-57, postmenopausal 12 to 36 months.

Eligible participants will receive:

- Free bone density scan (DXA) with interpretation of results
- FDA approved Micro MRI scan of wrist and spinal x-rays
- Study medication/placebo
- Calcium and Vitamin D supplements
- Physical exam and blood work
- Monetary stipend available

HAVE YOU HAD A BROKEN BONE?

You may qualify for a bone mineral density scan to evaluate your bone health at no cost to you. The study involves no medication.

Do you meet the following criteria?

- Ages 20-48
- Having regular menstrual cycles
- Not currently on treatment for osteoporosis
- The broken bone occurred after age 18

RESEARCH STUDY FOR 13 AND 14 YEAR OLD GIRLS

This is a one year research study at the Osteoporosis Research Center evaluating the role of dairy consumption on weight management.

Requirements:

- 5 visits
- Painless evaluations
- Monetary stipend

Please contact our pediatric nurses at 280-4070 for more information.

Support the Osteoporosis Research Center Endowment

The work of the osteoporosis research center as a local, national and international resource must continue.

An editorial appearing in the Omaha World Herald, November 13, 2006 reported a decline in funding for basic medical research by the National Institutes of Health (NIH): “Given trends in medical inflation, the current freeze in NIH funding means that universities face an increasing budgetary squeeze in trying to maintain basic medical research (the kind of non-directed research that private industry eschews).” During the past 40 years’ work of the Osteoporosis Research Center (ORC), much of our research has been funded by the NIH. Another source of funding has been the pharmaceutical industry that has contracted with the ORC to conduct clinical trials and laboratory work in the development of new drugs. Adding to the concern regarding research funding, an article in the December 6, 2007 issue of The Wall Street Journal: Big Pharma Faces Grim Prognosis indicates that production of new drugs is winding down. The ORC has successfully recruited new investigators and now a shortage of funding from both our major sources is occurring just at the time they need support.

An endowment was started in 2006 for the Creighton ORC to combat the squeeze mentioned in the World Herald editorial and the concern voiced in the Wall Street Journal. The goal for the endowment is to provide about \$400,000 per year, enough to support young investigators to the point that winning NIH funds is possible.

The vision of the ORC is to discover ways to prevent fractures at all ages, in particular, among aging men and women. There are 1,500,000 fractures annually in the U.S., costing over \$18 billion in health care. More than three fourths of the fractures are due to osteoporosis, and most of them occur in women past the age of menopause. Men also suffer osteoporotic fractures at about 1/3 the rate of women. The endowment will help build on our past successes.

FORTY YEARS OF RESEARCH ACHIEVEMENTS IN OSTEOPOROSIS:

- Set the U.S. government standard for recommended dietary calcium intake
- Determined the bioavailability of numerous calcium supplements
- Discovered the bone cell changes causing bone loss at menopause
- Discovered a gene mutation that prevents osteoporosis
- Contributed to the development of five drugs for treatment of osteoporosis
- Discovered in a pilot study that vitamin D supplements may prevent 60 % of all cancer

ONGOING AND FUTURE PROJECTS:

- ◆ Determine the action of vitamin D in preventing cancer
- ◆ Determine whether (and how) vitamin D prevents infections
- ◆ Determine whether vitamin D improves bone, muscle strength and well-being in patients on artificial kidney dialysis
- ◆ Determine standards for bone development in healthy children
- ◆ Determine the cause of bone loss at menopause
- ◆ Determine the genetic control of bone development
- ◆ Determine the genetic contribution to osteoporotic fractures

A pathway for many years of research in the field of osteoporosis lies ahead, a path extending well into the future beyond the current leadership of the ORC. Fulfillment of this promise to cure osteoporosis and prevent the devastating effects of fracture in the elderly requires that donations be made to the Center’s endowment to support the work of new leadership. **Solid endowment support for the Osteoporosis Research Center is crucial to its promising future.**



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