

Quiz Policies

Eligibility

The NCSF online quizzes are open to any currently certified fitness professional, 18 years or older.

Deadlines

Course completion deadlines correspond with the NCSF Certified Professionals certification expiration date. Students can obtain their expiration dates by reviewing either their certification diploma or certification ID card.

Cancellation/Refund

All NCSF continued education course studies are non-refundable.

General Quiz Rules

- You may not have your quiz back after sending it in.
- Individuals can only take a specific quiz once for continued education units.
- Impersonation of another candidate will result in disqualification from the program without refund.

Disqualification

If disqualified for any of the above-mentioned reasons you may appeal the decision in writing within two weeks of the disqualification date.

Reporting Policy

You will receive your scores within 4 weeks following the quiz. If you do not receive the results after 4 weeks please contact the NCSF Certifying Agency.

Re-testing Procedure

Students who do not successfully pass an online quiz have the option of re-taking. The fees associated with this procedure total \$15 (U.S) per request. There are no limits as to the number of times a student may re-test.

Special Needs

If special needs are required to take the quiz please contact the NCSF so that appropriate measures can be taken for your consideration.

Quiz Rules

What Do I Mail Back to the NCSF?

Students are required to submit the quiz answer form.

What do I Need to Score on the Quiz?

In order to gain the .5 NCSF continued education units students need to score 80% (8 out of 10) or greater on the CEU quiz.

Where Do I Mail My Quiz Answer Form?

You will mail your completed answer form to:

NCSF

Attn: Dept. of Continuing Education

5915 Ponce de Leon Blvd., Suite 60

Coral Gables, FL 33146

How Many CEUs Will I Gain?

Professionals who successfully complete the any continuing education quiz will gain .5 NCSF CEUs per quiz.

How Much does each quiz cost?

Each quiz costs the student \$15.00.

What Will I Receive When The Course Is Completed?

Students who successfully pass any of the NCSF online quizzes will receive their exam scores, and a confirmation letter.

How Many Times Can I Take The Quizzes For CEUs?

Individuals can take each NCSF quiz once for continuing education credits.

Establishment of Peak Bone Mass



It is common knowledge that health related activities are important for all systems of the body to function optimally. Of the different bodily systems, the skeletal system is one of the most forgotten and neglected. Generally, the skeletal system is not something that one thinks about unless there is a problem that causes pain. But like most things with our bodies, just because we don't think about them doesn't mean that they are not important. As you are probably aware, bones serve several key functions beyond providing support and structure. These other functions include storage of minerals, production of blood cells such as red and white blood cells, as well as providing protection for delicate tissues and organs. Although each of these functions are important in their own right, for the purposes of this discussion we will focus primarily on the role bone serves as a reservoir for calcium and how this relates to structural integrity.

The calcium salt of bone represents a valuable mineral reserve that maintains normal concentrations of calcium and phosphate in bodily fluids. These calcium and phosphate ions are necessary for multiple interactions that vary from initiating muscular contractions to regulating DNA. Many people think that bone is static and unchanging like a brick or boulder. This idea is incorrect. The organic and mineral components of bone are continually being recycled and renewed through a process of remodeling. Bone remodeling is under way throughout life and allows for repair of fractures, as well as provides calcium from its reserves during periods of stress or inadequate calcium intake.

When a bone's remodeling process is interrupted, the integrity of the bone is compromised. The abnormal conditions of bone osteoporosis and osteopenia are the most common outcomes. Osteopenia refers to low bone mass. This occurs naturally to a small degree as a normal part of the aging process beginning between the ages of 30 to 40. Once this process begins women lose roughly 8% of their skeletal mass per decade, whereas male skeletons deteriorate at a slower rate of about 3% per decade. When the reduction of bone mass is sufficient to compromise normal function it is referred to as Osteoporosis. Osteoporosis can lead to enhanced bone fragility and increased risk for fractures.

Most research in osteoporosis has focused mainly on the role of bone loss in the elderly population, but it is becoming increasingly clear that the amount of bone that is gained during growth is also an important determinant of future resistance to fractures. Thus, considerable interest is being

placed on defining preventive strategies that optimize the gain of bone mass during childhood and adolescence. Knowledge of the determinants accounting for the physiologic variations in bone accumulation in children will provide the best means toward the early diagnosis and treatment of osteoporosis. This article we will focus on the three major determinants influencing bone accretion during childhood and adolescence.

Bone mass accrual

Importance of peak bone mass

The amount of bone in the skeleton at any age is the result of the quantity of bone gained during growth, from uterine life to skeletal maturity, and the loss of bone that occurs with aging. Skeletal maturity and peak bone mass (PBM) occurs around age 20 to 30 years of age. Many factors contribute to the achievement of peak bone mass, which is regarded as the bone bank for the remainder of life. Acquiring a solid "account" contributes to counteracting the inevitable bone loss caused by aging, illness, and other insults. Understanding the mechanisms that regulate PBM allows the institution of early preventive strategies and enhancement techniques aimed at maximizing the amount of bone that can be gained during growth.

Critical years of bone mass increments

Skeletal mass increases from approximately 70 to 95 g at birth to 2400 to 3300 g in young women and men, respectively⁽³⁰⁾. These gains proceed at different rates at various skeletal sites. Studies have shown that gains in bone mass are rapid during adolescence and that up to 25% of PBM is acquired during the 2-year period across the adolescent growth spurt. During the peak of the growth spurt, boys and girls have reached 90% of their adult stature, but only 57% of their adult bone mineral content (BMC). At least 90% of PBM is acquired by age 18. The density of bone is strongly influenced by hormonal or metabolic factors associated with sexual development during later stage adolescence.

Gender differences

Bone mass is greater and the incidence of fractures is lower in men than in women. However, recent evidence indicates that bone density does not differ between men and women; this challenges the view widely held for many years that gender differences in bone mass were due to differences in bone density.

Observations using CT scans indicate that, throughout life, females have smaller vertebral body cross-sectional area when compared with males, even after accounting for differences in body size. On average, the cross-sectional area of the vertebral bodies is 11% smaller in prepubertal girls than in prepubertal boys matched for age, height, and weight^[5]. This disparity increases with growth and is greatest at skeletal maturity, when the cross-sectional dimensions of the vertebrae are about 25% smaller in women than in men, even after taking into consideration differences in body size^[4]. Thus, the phenotypic basis for the 4- to 8-fold higher incidence of vertebral fractures in women compared with that in men may lie in the smaller size of the female vertebra.

In contrast, the cross-sectional dimensions of the femur do not differ between males and females matched for age, height, and weight. The cross-sectional and cortical bone areas at the midshaft of the femur are primarily related to body weight, regardless of gender; this notion is consistent with models proposing that long bone cross-sectional growth is strongly driven by mechanical loads. With this said, the reasons for the gender differences reported by some investigators in the incidence of hip fractures are unknown.

Recent evidence also indicates BMD of the long bones is similar in boys and girls. Data obtained in a large sample of healthy subjects indicated that there were no differences in BMC and bone mass density (BMD) during the prepubertal period. Surprisingly, during puberty, BMD values in girls were higher in the pelvis and spine, whereas measures in postpubertal boys were higher in the whole skeleton. Peak BMC and BMD was achieved between the ages of 20 and 25 years and occurred much earlier in girls than in boys.

Tracking of bone mass

The amount of bone that is gained during adolescence is the main contributor to PBM, which, in turn, is a major determinant of osteoporosis and fracture risk in elderly persons. In one study, bone mineral measurements of premenopausal mothers and prepubertal daughters showed considerable familial resemblance at all skeletal sites suggesting a hereditary pattern^[2]. Moreover, values in the daughters 2 years later correlated strongly with baseline values. Various studies have shown that BMD and bone size tracked through growth demonstrated that BMD maintained the same position in the normal distribution at the end of puberty as was present in the prepubertal period^{[1] [6] [8]}. Thus, we are now in a position to identify children who are genetically prone to develop low values for peak bone mass. These children are ideal candidates for early osteoporosis prevention methods.

Determinants of bone mass

Studies on various sample populations show that about three fourths of the variance in peak bone mass is attributable to hereditary factors. The remaining fraction of the variance in peak bone mass is caused by environmental factors, such as nutrition and physical activity behaviors.

Hereditry and bone mass

Genetics

The obvious application of genetic studies to osteoporosis and bone mass is the discovery of genetic markers that

consistently predict osteoporotic fractures and allow the early identification of subjects at high risk. Understanding the role played by genetic factors may also facilitate the prediction of response to treatment. For example, the response of bone mass to dietary supplementation with vitamin D and calcium is partly dependent on the vitamin D receptor (VDR) genotype^{[10] [11] [12]}. It is possible that other genes may aid in identifying subjects who would benefit from treatments such as hormone replacement therapy, medical therapy, or exercise.

Hereditry is an important determinant of bone mass. Data from mother-daughter pairs, sibling pairs, and twin studies have estimated the heritability of bone mass to account for 60% to 80% of its variance. The magnitude of the genetic effect varies with age and between skeletal sites; it is higher in young than in elderly persons and in the spine than in the extremities. Further support for this genetic influence comes from studies showing reduced bone mass in daughters of osteoporotic women when compared with control subjects^[13], and in men and women with first-degree relatives who have osteoporosis. A review of all the recent genetic/hereditary data involving osteoporosis is beyond the scope of this article. However, it appears that in the near future genetic tests will be available to not only identify those individuals in the general population with a hereditary risk for osteoporosis, but also indicate what type of medical therapy these individuals will best benefit from.

Ethnic differences

The prevalence of osteoporosis and the incidence of fractures are substantially lower in black than in white persons, a finding generally attributed to racial differences in adult bone mass^[16]. Whether these racial differences are present in childhood has been the subject of considerable interest. Some studies found the bone mass of black children to be greater than that of white children, whereas others detected no racial differences in bone mass. However, investigations using CAT scans looking at the different types of bone have found that, regardless of gender, race has significant and differential effects on the density and the size of the bones. This difference becomes apparent during the late stages of puberty and persists throughout life. One study looked at a kind of bone called cancellous bone. Before puberty, cancellous bone density is similar in black and white children; during puberty, it increases in all adolescents^[14]. The magnitude of the increase from prepubertal to postpubertal values is substantially greater in black than in white subjects. Thus, theoretically, the structural basis for the lower vertebral bone strength and the greater incidence of fractures in the axial skeleton of white subjects resides in their lower cancellous bone density. Limited data from Asian and Hispanic youth suggest that their bone mass is similar to that of Caucasian children, but much lower than that of African American children.

Influence of environment and behavior on bone mass

Physical activity

The impact of exercise and physical activity on skeletal integrity has generated considerable interest over the last two decades. The theoretical foundation for a direct effect of exercise on bone mass is based on the relationship between the intensity of pressure or strain on bone and the adaptation of bone to that stimulus. Keep in mind that bone is not static and is constantly remodeling. Remodeling is the body's way of

balancing bone depletion and formation. According to the above model, whenever activity falls below the physiologic minimal effective strain threshold, bone depletion exceeds bone formation. In contrast, net gains of bone occur only when the intensity of loading is increased above the physiologic loading zone. This model explains the bone loss observed during immobilization and the increased bone mass of elite athletes.

The beneficial effects of exercise on bone mass are well documented through multiple observational and retrospective studies indicating weight-bearing activities increase bone mass. The earliest studies were comparisons of bone structure in tennis players. In these studies, long-term players were found to have higher bone mass in the playing arm than in the non-playing arm^{[24] [25]}. In addition, other investigators have reported that the bilateral difference in bone mass was two to four times greater in female players who started training before puberty. In other studies, children and adolescents who were physically active accrued more bone mineral than their sedentary peers, and a more recent study demonstrated that physical activity levels were positively associated with total body bone density in preschool children^[19].

Studies comparing the effects of different physical exercises on bone indicated that high-impact exercises resulted in the greatest increases in bone mass in adolescents^[30]. Similarly, gymnasts had higher spine and femur bone density than swimmers or sedentary girls. Amateur athletes involved in weight-bearing sports (e.g., rugby, soccer, endurance running, fighting sports, and bodybuilding) had higher values for total body and leg bone density than amateur sportsmen involved in active loading activities (e.g., swimming and rowing)^[22]. Of the studies that demonstrated a benefit from activity, all had duration of at least 8-10 months and a frequency of 3 times per week for 15 minutes. Furthermore these studies involved persons between the ages of 10 to 18 yrs.

The beneficial effect of physical activity on the growing skeleton is believed to be maintained throughout adulthood and the enhancement of bone acquisition during growth due to exercise interventions may be long lasting. It has been shown that individuals that partake in a weight bearing activity in their youth and stop have higher bone densities than those who never participated. Additionally, it has been shown that those persons who stop participating in weight bearing activities as adults have lower bone densities than those who continue to participate. So it appears that lifetime participation of activities produce higher bone density and thus lower risk for fractures.

Calcium and bone mass gains

Studies have shown an increased prevalence of osteoporosis in regions where dietary calcium intake is extremely low. Furthermore, convincing evidence that calcium consumption influences rates of bone mineral accrual comes from controlled calcium supplementation trials in young healthy subjects. These studies showed that subjects given

additional calcium for 1 to 3 years had greater gains than did those who were not given supplements. Other studies suggest that supplementation may benefit until age 30 when most individual reach PMB. The advantages to calcium supplementation after age 30 is still not fully known but believed to also provide some benefit.

Lifestyle factors

Even healthy children and adolescents might fall short of optimal bone health because of current lifestyle trends. A few trends are likely to manifest during adolescence. First, inactivity poses a great threat to bone mineral gains. Television viewing and computer use continue to increase, and the time spent in physical activities is declining. This habit seems to be more frequent in selected groups of youths^[22].

A second trend is the increasing use of tobacco among adolescents^[23]. Tobacco use generally begins during adolescence and is variably associated with a reduced BMD^{[24] [25] [26] [27]}. The decrement of bone mass observed in young smokers is generally modest. However, because those who begin smoking at an early age are more likely to continue to be heavy users^[28], they are more likely to experience the increasing, cumulative decrements in bone density^[29].

Although little is known about the effect of alcohol use and abuse on bone gains in adolescents, in adult men and women, excess alcohol intake seems to have an adverse effect on the preservation of bone mass, mainly by suppressing bone formation^[30]. For this reason, alcohol abuse may have an adverse affect on skeletal development in adolescents.

Summary

Among the main areas of progress in osteoporosis research during the last decade or so are the general recognition that this condition, which is the cause of so much pain in the elderly population, has its antecedents in childhood and the identification of the structural basis accounting for much of the differences in bone strength among humans. Nevertheless, current understanding of the bone mineral accrual process is far from complete. The search for genes that regulate bone mass acquisition is ongoing, and current results are not sufficient to identify subjects at risk. However, there is solid evidence that bone density measurements can be helpful for the selection of subjects that presumably would benefit from preventive interventions.

The questions regarding the type of preventive interventions, their magnitude, and duration remain unanswered. Further investigation is still needed. Nevertheless, previous experience indicates that weight-bearing activity and possibly calcium supplements are beneficial if they are begun during childhood and preferably before the onset of puberty. Modification of unhealthy lifestyles and increments in exercise or calcium assumption are logical interventions that should be implemented to improve bone mass gains in all children and adolescents who are at risk of failing to achieve an optimal peak bone mass. ●



CEU Quiz

Bone Mass

- Which of the following is a function of bone?
 - Storage of minerals
 - Production of blood cells
 - Protects organs
 - All of the above
- Which of the following statements is true regarding bone remodeling?
 - Bone cell production stops at age 50
 - Bone renewal is a constant on-going process
 - Bone cell remodeling only occurs in weight bearing bones
 - All of the above
- At approximately what age does bone mass loss begin to occur in response to the normal aging process?
 - 18-25
 - 25-30
 - 30-40
 - 45-50
- What percentage of peak bone mass is attained by age 18?
 - 35%
 - 50%
 - 75%
 - 90%
 - 100%
- What is the normal rate of bone loss per decade for the average female in response to the aging process?
 - 1%
 - 5%
 - 8%
 - 10%
- Which of the following statements is correct when males and females are compared relative to size?
 - Axial skeleton is smaller in females
 - Cross sectional femur size is equal
 - Total body bone mass density is higher in adult males
 - All of the above
- Which of the following statements is false regarding risk for osteoporosis?
 - Genetics do not affect risk for osteoporosis
 - Resistance training reduces risk for osteoporosis
 - Caucasians have a higher risk than African-Americans
 - All of the above
- What affect does weight bearing activity have on the bone mass density of children?
 - Increases BMD
 - Decreases BMD
 - No effect on BMD
- During which age segment is adequate calcium most important for bone mineral density?
 - 11-30
 - 31-50
 - 51-70
 - All are equal
- Which of the following lifestyle factors is considered an obstacle to bone health in adolescents?
 - Physical inactivity
 - Tobacco use
 - Inadequate vitamin D
 - All of the above

Quiz Answer Form

FIRST NAME _____ LAST NAME _____ M.I. _____

TITLE _____

ADDRESS _____ APT. _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

COUNTRY _____ POSTAL CODE _____

CERTIFICATION NO. _____ CERTIFICATION EXP. ____/____/____

MEMBERSHIP NO. _____ MEMBERSHIP EXP. ____/____/____

Quiz Name	Member Price	Total
	\$15	



Discover



Visa



Mastercard



Amex



Check/Money Order

Account No. _____

Exp. Date _____

Security Code _____

Signature _____

Date _____

Quiz Answers

1. _____

6. _____

2. _____

7. _____

3. _____

8. _____

4. _____

9. _____

5. _____

10. _____

Fill in each blank with the correct choice on the answer sheet. To receive 0.5 CEUs, you must answer 8 of the 10 questions correctly.

Please mail this Quiz answer form along with the proper enclosed payment to:

NCSF
5915 Ponce de Leon Blvd., Suite 60
Coral Gables, FL 33146

Questions? 800-772-NCSF