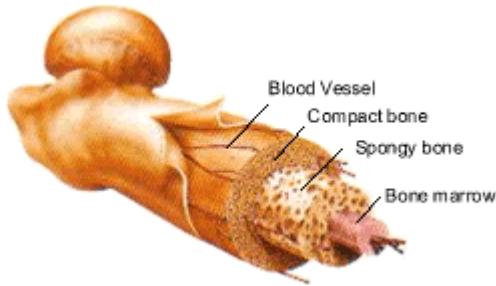


## The Mechanics of Bone Tissue Part III



Researched and Composed by Jacob Wilson, BSc. (Hons), MSc. CSCS

### Abstract

The final installment of this series will discuss exactly how to increase bone shape, mineral content, strength, elasticity, and fatigue resistance. The importance of this subject is without question. For the athlete involved in weight training and field events, a rock hard skeletal system will make them near impervious to fractures. Furthermore, a direct relationship between strength and bone density has been shown (50). Hence, by enhancing your skeletal system, you will in turn enhance your ability to lift heavier, hit harder, and run faster. Finally, I will address the effects of weight training in youth, and specific issues dealing with female athletes, and elderly individuals.

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### Factors Involved In the Increase of Bone Efficiency

Bone strength, fatigue resistance, and elasticity increases by enhancing mineral content, density, cortical width, increasing the size of the medullary cavity, and building up trabecular density in specified regions of stress. Three factors must be considered when attempting to increase each of these areas.

1. Training and detraining have direct effects on bone growth( 29, 30, 32, 47 )
2. Nutrition has a direct effect on bone growth (4, 10, 13, 39, 48)
3. Hormonal environment has a direct effect on bone growth (12, 31, 40 )

We begin our investigation with factor numero uno.

## Training and Its Effects On Bone Growth

Proficiency is of the essence in this particular situation. Therefore it would behoove us to lay out some empirical facts.

**1.** Physical Activity and Gravity have a proportionally directed effect on bone growth (15, 49). For example during a Skylab mission, lasting 28 days, crew members lost an average of 50 mg of calcium from their bones daily (2), while on an 84 day mission Astronauts averaged a 140 mg loss (2). Moreover, those who are regulated to constant bed rest, or a lack of activity show extreme losses in bone mass (20).

On earth, one constantly must deal with a significant gravitational pull. When comparing the athlete who increases the load on his or her body, to sedentary counterparts, it is consistently found that the former has a marked increase in overall mineral density (27, 46). Jacobson et. al and Riser et. al, both showed that not only do active individuals have more comparative mineral density than non active, but that those who perform weight bearing activities( running, weight training etc. ) had a higher density than those who performed non weight bearing activities( I.E. swimming )( 27, 46 ).

We can therefore conclude that both activity, and load directly effect bone density. To illustrate my point, Dalsky et. al had sedentary individuals perform weight bearing activities for 22 months. At the end they had increased their spinal mineral density by nearly 7 percent. However, following the study, they regressed to their sedentary life styles for the next 12 months. This resulted in a loss of all but 1 percent of their gained bone mineral density.

The question therefore is, what is the most effective training style for developing bone mass? Hold that thought for a minute, while we discuss factor number two.

**2.** Loadings effects on bone are " specific. "

This once again follows wolfs law, meaning that it is the muscles, which are directly stressed that will show the greatest adaptation. Huddleson et. al illustrated this in a study involving tennis players. They state the following:

The bone mineral content of the radii of experienced male tennis players was measured. The bone mass of the radius of the playing arm

(mean, 1.37 g/cm) was greater than that of the nonplaying arm (mean, 1.23 g/cm) in all but one person (26).

Therefore running activities will increase the lower extremities mineral content, but do relatively little for the upper limbs.

## **How To Optimally Build Bone Mass**

There are three main methods for measuring the health and strength of the bones in your body. The first is absorptiometry which makes use of X-Ray technology in its measurements (9, 37,42). Secondly physiologists will utilize biochemical elements, such as circulating hormones, which indicate bone growth. Thirdly, and what we are most interested today is the relationship between strength and bone mineral density (50).

As mentioned, specificity is an important factor in bone strength. Which is why Snow-Harter and colleagues, in the journal of bone and mineral strength showed a direct correlation between back extension strength and lumbar spine mineral density. This was tested for the full gamut, including hip adductor strength and hipbone mineral density, as well as grip strength and forearm bone mineral density (50).

There was another fascinating find however by these scientists. They actually discovered that in many cases a correlation between different exercises affected what many would feel as uncommon threads. For example the strength of the biceps brachii was correlated to both spine and hip strength. When you think about it for a moment however it makes perfect sense. Our bodies function as a unit. Meaning the vertebral column is not simply used in dead lifts, but in countless other movements to stabilize the body! What I want to now emphasize is the property of imbalance. You see, as stated earlier in this series, stress fractures occur to body parts which are continually over used. For those who advocate little variety in their training, they not only develop an imbalance in muscular strength, but an imbalance in bone density. Going back to the spine, one must realize that it is composed of well over 30 vertebrae, each with several specific interwoven parts! We often hear that all one has to do is 4 or 5 basic exercises, and this could not be further from the truth, not just for the hypertrophy athlete, but also for the strength athlete!

If one wants to strengthen their squat and dead lift, they need an exceptionally brute strong, calcium-fortified spine! It is for this reason that one should emphasize variety. Rather than use one form of the good morning, utilize it from a variety of positions, and do not shy away from training all body parts, including biceps. Realize

that every angle not only increases muscularity and skill, but also affects each bone in the body in a " specific " way. Therefore more angles will cause the bone structure to adapt more fully. As the saying goes, one weak link can break the whole chain. You can have a strong bench, and squat, and due to neglect of other exercises find that weak link when you least expect it! Whether on the field while playing football, or in the weight room when attempting a new maximum lift! Also realize the tuberosities which protrude out of your bones will be increased. That is to say, that an athlete must appreciate that several tendons insert on various bones, and that by working through a variety of exercises you increase the size of that region on the bone. As you recall, the tensile strength of bone is equal to steel, meaning every inch added counts.

### **Overload Principle Applied to Bone Mass**

As we have demonstrated, bone adaptation is specific to activity and load. Studies show that the overload principle is vital in bone tissue. There are three specific ways to accomplish this. The first is frequency (how many times a week the bone is forced to work), intensity (size of the load), and repetitions (17). Of these three aspects, studies indicate that intensity is the highest deciding factor in producing increased bone mineral content (5). Bone is crystallized( calcium and phosphorus ), and has the ability to turn mechanical energy into electrical energy. It is theorized that this electric energy stimulates osteoblasts to increase calcium absorption processes, and to lay down osteoid ( bone matrix that is uncalcified,). Again, the higher the load the greater the response in growth.

### **Tips For Building Bone Mass**

1. Incorporate heavy days. This is one of the most traditional forms presented by The Austrian Oak. Here is how he used the method:

" In my case, this meant doing a greater proportion of higher rep isolation training, making sure I sculpted each muscle and achieved the greatest amount of definition and separation possible. But I never wanted to lose the basic thickness, density, and hardness that my early training had created. That is why I always scheduled " heavy days " in my training routine. Once a week or so I would pick a body part and go to the maximum with strength moves that worked that area. When training legs for instance, I would try for a maximum Squat; for chest, a maximum strength Bench Press, and so on. By training this way I would not tax my body to such an extent that it could not recuperate before my next workout. But by going to the maximum on a regular basis, I gained a very accurate perception of just how much progress I was making in developing my strength, and by forcing myself to go to the limit every so often, I counterbalanced the lighter weight, higher rep training that made up the majority of my workouts (3). "

**Arnold Schwarzenegger**

2. A second technique which was presented by Mr. Knowlden in Shock Yourself Out Of The Comfort Zone 3 can work wonders (7). It is called the dead weight technique, and allows an athlete to handle loads presently out of his or her lifting parameters (7). It increases ones strength rapidly, and one of the reasons for this, is that it enhances bone mass. For a full report on how to perform this method I would ask you to [click here](#)

3. The final consideration involves ground reaction forces. According to Dr. Witz and Dr. Snow in the journal of sports medicine, ground activities must be high in intensity (50, 58). They constitute low intensity ground reaction forces to be between 1 and two times a persons bodyweight. Further, two to four fall into moderate and any force greater than four constitutes high intensity (50, 58). There is a technique, which has been shown to safely load the skeleton with up to seven times its bodyweight! It is known as shock training, or " plyometrics. " Witz and Snow compared one physical education course in which participants were extremely active, compared to a group of individuals performing plyometrics. The plyo group gained more bone mass in all then the former (58). You can look for some massive information on this technique this year in hyperplasia magazine. However, what I will do now is give you a base on what they are, in addition to the past paragraphs I have written on the subject.

As you well know, shock training consists of highly explosive movements, such as the depth jump. Lets analyze a single leg jump.

1. Step One - In this exercise, you will stand on one leg. Make sure you have good spring and support in your shoes. You simply jump as high as possible in the air on one foot, then swing your arms up for maximum height and prepare to land. When you land, minimize the time between the ground and your second jump as much as possible. This is because your muscles, and connective tissue are storing vital potential energy.

2. The landing phase is called the [Amortization phase](#) - That is, the length of time which elapses between the eccentric aspect as the muscle lengthens, and stores potential energy.

3. Jump back up and repeat

For legs you can utilize depth jumps( jump off of a platform, and jump straight in the air as soon as you hit the ground ), or single leg hops. For the upper body you can utilize clap pushups, and medicine ball passes.

## Putting It all Together

1. Utilize a variety of angles. Meaning, if you perform good mornings, perform them standing, bent legged, seated, etc. Do not stick with just bench and squats. You need to utilize a variety of combinations. Remember, bone density is specific. By only using a few exercises, you create muscular and bone imbalances, and risk

stress fractures. Several studies actually show that by overdoing one activity you will decrease bone density.

2. According to Dr. Frost bone growth depends on a " threshold stimulus, " which he calls " minimal effective strain (18). " He believes that this threshold must be reached, and then repeated several times( in a short time period however like 5-30 seconds ). I would not recommend more then 6-10 jumps using plyo, and these are explosive. This is also referred to as the " stress strain " relationship. That is, bone mass is positively effected by the degree of stress placed on it( to a point ). The " Knowlden Dead Weight Method (7) " will build density, as will heavy lifting and plyometrics. It is for this reason that a program, which seeks to increase density, will want to include one of these methods in a given workout. For example

### **Leg Day**

Three Sets of Squats. In between sets( after resting 3-5 minutes ) perform depth jumps

Then continue your normal routine

### **Chest Day**

Begin By Utilizing The Knowlden Dead Weight Method. Then continue normal training, or perform clap pushups between bench presses.

### **Back Day**

Perform super heavy dead lifts when your CNS is fresh.

I would suggest at least once to twice a year really focusing on bone density. You will also notice mass increases in strength, size and freakiness.

## **What Nutritional and Hormonal Factors Influence Bone Growth?**

As painfully obvious as it is, one needs to have a proper bodybuilding diet in order to induce bone growth. In other words, do not expect to eat like trash, and subsequently reap great results in either muscular or bone growth. My main concern today is therefore outside of the " heart " of nutrition, and essentially focusing purely on specific key factors involved in bone growth.

### **Hormones Which Positively Effect BMD**

This is simply an overview of hormones effecting growth. Mr. King has opened up the endocrine system to our members this month with a bang! And each of these hormones will be covered in future additions to this section.

- Growth Hormone and Insulin Like Growth Factor – Stimulate Cell Division and direct Growth
  
- Insulin – Required For IGF secretion
  
- Testosterone – Actively stimulates secretion of Growth Hormone and Insulin Like Growth Factor
  
- Thyroid Hormones – Required for the synthesis of GH and are also required for GH to have an effect on the target tissue.
  
- Calcitronin – See below
  
- Calcitriol – See below

#### Nutrients, Minerals, & Vitamins Which Positively Effect Bone Growth

- Vitamin D
- Vitamin C
- Calcium
- Phosphorus when not in excess
- Certain Foods which increase absorption
- Certain Proteins which increase absorption

#### Hormones Which Have a Negative Effect on Bone Growth

- Parathyroid Hormone

#### Nutrients, Minerals, Vitamins & Habits Which Negatively Effect Bone Growth

- Phosphorus in excess
- Certain amino acids, namely sulfide containing AA's
- These compete for absorption with calcium
- Excess Sodium
- Alcohol
- Smoking

We will now key in on specific mechanisms, beginning with actions of three specific hormones, which are directly responsible for regulating calcium levels. The first is called parathyroid hormone, and as the name suggests it is secreted by the parathyroid gland( in the neck ). Its mission is to increase plasma levels of Calcium. One of the mechanisms for accomplishing this is to enhance bone resorption( the breakdown of bone tissue ). The stimulus for its release is, of course lowered plasma calcium levels. The hormone which acts opposite to parathyroid is Calcitonin, which is secreted by the thyroid gland via C-cells and increases calcium deposition (uptake) in bone tissue. The stimulus for Calcitonin secretion is increased levels of blood calcium levels. Finally, the third hormone of consequence is Calcitriol, which acts like a steroid hormone (meaning it enters the cell and has receptor sites on the cell nucleus) and increases calcium receptors in the digestive track, which in turn increases Calcium uptake from ingested food. Therefore we want Calcitriol, and Calcitonin up, and parathyroid hormone down. By accomplishing this, we will effectively increase bone formation, and decrease resorption.

### **If Plasma Calcium Levels are An Important Factor, Then How Do I manipulate them?**

First, I need to emphasize that most people are deficient in this mineral (39, 48). It is a fact that this is by far a grave, grave mistake, which will have grave consequences. **Unfortunately** osteoporosis (pore mineral density) affects over twenty five million individuals over the age of 45 (55) in the U.S. alone. Moreover, this is the cause of over 1.5 million fractures a year (34)! By paying extra attention to bone mass you can not only avoid this, but also build tremendously strong and massive bones as you do age. I will discuss this further in age related bone development below.

With mild deficiency, you may not experience these symptoms, but if you are, it is almost a sure sign of your lack in this mineral(  $Ca^{++}$  ). The first sign is unwanted, or involuntary Tetany (48). You will be aware of this by involuntary muscular contractions. Following this you may have muscle spasms, and numbness or tingling in your hands or feet (48). These are all signs of hypocalcemia( lower than normal  $Ca^{++}$  plasma levels ). In order to keep this macro mineral's concentration up in the plasma and stimulate Calcitonin we need to address Digestion, absorption, and of course supplemental and dietary sources.

**Digestion** –  $Ca^{++}$  is made soluble in about one hour following ingestion. However, it may not be absorbed, and in fact much is not. Which brings us to absorption

**Absorption** – According to Dr. Lohman absorption occurs in the small intestine, and mainly in the ileum( a section of the small intestine ). He states that two processes are important for this minerals uptake (34). The first is due to the hormone calcitriol, which was discussed earlier. Calcitriol enters into cell nuclei in the intestine, and causes them to synthesize calcium transporters known as Calbindin (34). The precursor to this hormone is what you know as Vitamin D. Which is why Seksi so recommended it, in his review on this vital subject (48).

It also increases absorption of phosphorus, which is also a vital mineral in bone

tissue. Interestingly enough, Vitamin D supplementation was made famous as a cure for Rickets. This is a disease that afflicts youth who are calcium deficient. It is theorized that Calcitriol also has a role in suppressing parathyroid hormone (10, 13), the hormone responsible for bone breakdown. You can of course get Vitamin D from fortified Milk, or the sunlight. I would recommend a minimum of 200 IU a day. Fortunately just 10 minutes in the sun can give you that, or a simple 400 IU supplement.

With the massive problems occurring world wide, many scientists feel that the RDA is simply not enough to satisfy calcium requirements. In the journal of Nutrition, Andon and colleagues believe that this needs to be significantly increased. For example, the RDA for ages 9-11 is 800 mg, but the NIH consensus Panel believes it should be in the upwards of 1200 mg daily. Evidence is stacking that it can be higher than this. For example in several studies, it has been shown that 1200 to 3000 mg daily being supplemented resulted not only in increased BMD, but actually decreased bad cholesterol (LDL) and increased good cholesterol (HDL). The reason for this is due to a soaping effect. You see, in order to digest fats, your liver secretes a substance known as " Bile. " This does what we call emulsification of fats. Meaning it physically breaks them down into easily digested fragments ( can be chemically broken down).

Ca<sup>++</sup> inhibits reabsorption of bile salts, which is composed party of fatty acids. Thus, the body must take its stores of lipoproteins and use it to synthesize new bile, which in turn decreases low density lipoprotein( bad cholesterol ) levels.

The question however is what levels of Ca<sup>++</sup> are toxic? According to Dr. Yates and colleagues from the Journal of American Dieting Association, an upper limit of 2500 mg daily of exogenous calcium can be taken safely. Which is why I whole heartily concur with Seksi on his recommendation( he recommends a thousand milligrams per 100 pounds of bodyweight of calcium citrate )( 48 ).

Finally we need to assess what items decrease the absorption of calcium, and also what increases its absorption. Proteins semi balance each other out. There are several which actually increase absorption, while still others which contain sulfur and increase calcium loss through the Urine. However, a decent balance is reached, even though a high protein intake, overall does decrease Ca<sup>++</sup> absorption. Another reason to supplement with this vital mineral! I would also not recommend supplementing with Phosphorus( it is plentiful in your diet already). For example one study showed that a higher calcium intake combined with a phosphorus intake of 1800 mg a day causes a significantly higher loss of Ca<sup>++</sup>(8). This is due to several factors one of which is phosphorus role in the stimulus of parathyroid secretion. Interestingly enough, several soft drinks contain this substance. And children who drink copious amounts of pop, while simultaneously in a hypocalcemic state are risking bone fracture now, and mainly latter in life. Finally, both smoking and alcohol consumption severely depletes calcium stores! The reason smoking is detrimental, is due to the fact that it suppresses estrogen levels which clearly have a positive effect

on bone growth. Alcohol consumption lowers Vitamin D uptake, and calcium uptake.

**Does Proper Weight Lifting Have a Stunting Effect on Bone Growth, and Can you Give a summary of How Bone Grows Throughout Life?**

The answer, in order is no and yes. No, weight lifting performed properly does not stunt growth, and yes I can give a summary.

In the journal of strength and conditioning, Dr. Burgener was asked about the safety of lifting for adolescents. The dialogue is as follows

**Question:** Can you Comment About the General Safety (Injury Rates, etc.) of Resistance Training for Youth Populations?

**Answer:** Dr. Burgener: My experience has been working with students between the ages of 8 and 20, and I can honestly say that I have never had a student or athlete become seriously injured as a result of resistance training. I have had students whose injuries resulted from negligence on their part, dropping a weight on their foot while unloading the bar, hitting their fingers while loading a weight. However, I have never seen a broken bone or dislocated shoulder/elbow during my 25 years as a strength coach. I, personally, believe that resistance training, when properly supervised, is one of the safest activities for our students (22).

Dr. Sprynarova in the Journal of Applied Physiology found that training did not affect growth before, during and after puberty (51). Dr. Plowman and colleagues, took precise measurements in all areas of athletes compared to non athletes between the age of 7-12 and found that " Both groups exhibited similar and significant correlations between age, HT, WT, B, and PH development but not %BF (41). " The body fat measurement is an obvious. Gurd et. al testing intense male gymnasts, which is extreme in weight bearing activities " concluded that although there is a higher energy expenditure accompanying intense training in young male athletes their body composition is not necessarily affected, and there is no determined effect on their physical and pubertal development(23). "

Dr. Profex a Program Coordinator of Health and Fitness and a professor at Hesser College, stated that " The fact is that resistance training for conditioning as well as weightlifting as a sport involve a far lesser degree of risk of injury than most other

popular forms of sport, including soccer, basketball, and football (22). In the journal of Sports medicine, Dr. Ryans and several other scientists investigated the study of strength training and youth and found that " Effects on growth and development, flexibility, and motor performance were also investigated, as these are factors with an impact on sports injury occurrence. Results showed that in the short term, supervised concentric strength training results in a low injury rate and does not adversely affect bone, muscle, or epiphyses; nor does it adversely affect growth, development, flexibility, or motor performance (45). " Lillegard et. al. in the journal of Pediatric Rehabilitation studied the effects on weight training on youth and concluded that their "findings support the general observation that physical benefits can be gained safely by children who participate in a weight training program(33). "

In addition to the above scientific journals, I would purpose to you, that weight training for younger athletes is a must. Dr. Metcalf and Dr. Roberts on a journal review of weight training and youth stated that " recent evidence suggests that, properly done, strength/resistance training may not only be safe, it may also help reduce the risk of injury for the young athletes (38). " In fact, Dr. Faigenbaum in the journal of Clinical Sports Medicine concludes that " regular participation in a youth strength-training program has the potential to increase bone mineral density, improve motor performance skills, enhance sports performance, and better prepare our young athletes for the demands of practice and competition (16). "

### **Peak Bone Mineral Density**

Dr. Faigenbaum made an outstanding point above in regards to BMD. It actually has extreme significance for the young athlete. You see, there is a phenomenon, known as " peak bone mass. " This refers to the time in one's life when the skeletal system reaches its height in BMD. Such an occurrence, normally takes place by the age of 30. However, from my research it can be influenced greatest between the ages of 11 and 20. It is a fact that weight training individuals; both in youth and in adult hood have higher densities then their inactive counterparts. It is also a fact that bone formation is heightened for youth, to a much greater extent then past the age of peak bone mass. For example, according to the National Research Council of the United States, the average absorption rate of calcium through exogenous intake (from outside of the body), is in the upwards of 75 percent for growing children, as compared to 30 percent for adults.

With that in mind, hungry young men, and woman, can drastically add bone mass to their frames, that will increase the quality of not only their athletic futures, but also keep them free from age related fractures, and bone diseases!

Finally, I would assert that weight training, as Dr. Profex stated, is safer then other athletic activities. Think about it. A pitcher is constantly overusing his arm, and can develop serious muscular and skeletal imbalances. A bodybuilder eliminates imbalances. In fact, symmetry is the name of the game in this sport. Parents and Coaches, should realize, that by encouraging their sons and daughters to train, and diet correctly (one cannot occur without the other!), they are not only improving the quality of their lives now, but in the future as well.

## Are There Any Main Concerns That Younger Athletes Should Be Aware Of?

A main concern comes during puberty when an athlete accelerates in growth the most. During this stage, bones lengthen exceedingly, and in turn stretch / strain ligaments and tendons quite a bit. This is why weight training is actually a positive for athletes participating in field sports. If they have weak insertion points, and experience a growth spurt, then an injury can occur. During rapid growth, the athlete needs to be on a concentrated stretching program! I emphasize this tremendously to all coaches, and athletes. You need to emphasize the warm up, the stretching period, the cool down, and the post workout stretching period. And I underline **emphasize!**

Here is a list of tips for younger athletes

- 1.** Emphasize form, first and foremost. Your repetitions should be succinct, and text book. This is the skilled aspect of the sport, along with posing.
- 2.** Do not overuse a movement. This leads to muscular, and skeletal imbalances. If you are a tennis player for example, you may be imbalanced. Weight training, through a use of angles, and variations will solve this problem.
- 3.** You have an advantage, in that this sport is just as much mental as it is physical. Realize that you need to develop your mind, just as efficiently as your body. Therefore study, exercise your mind. Before trying a new technique or exercise physically, perform it mentally. Gain an understanding of what it is doing, and how you are to utilize it.
- 4.** Understand your personal anatomy. Ignorance is not bliss! Weight training is a science. Fortunately it is one, which is entangled in many of the other sciences, such as biology, physiology, anatomy, neurology, mechanics, bioenergetics, and much more. Thus, you will broaden your ability to not only dominate the gym, but the classroom as well.
- 5.** Warm up properly each and every session! The muscle being worked should be thoroughly warm, and you should have a good sweat. Once warm, take the time to stretch. Flexibility is a big part of this sport as well, and will relieve any unnecessary stress placed on tendons as you grow in height. Cool down properly and stretch as well.
- 6.** Have fun! Realize that you are living a healthy, and productive lifestyle. And also that you have plenty of support. From your parents, and family, and also right here on abc, from friends and fellow athletes. This is an environment designed to help you grow and achieve your goals!

## Females And Bone Density

This subject is very much centered around the hormone estrogen. Which is why it will be covered in the future in our endocrine system. Briefly, this androgen, is very influential on BMD. It is important that coaches, who train females, emphasize a proper diet and exercise program for a female's desired weight. If you are coaching, you need to be active, in making sure that your athletes are not abusing their bodies to reach their desired physiques, as this is a common thread. Instill in them positive values, and let them know that they can reach their goals in a much more productive manner through health related activities. Many female athletes who starve themselves have the bone density of the unexercised elderly, because of unhealthy habits. Look for a much greater detailed discussion of this very soon.

### **How can I help my relatives with this knowledge?**

My advice is to be straightforward. If you have sedentary relatives, let them know that if they are young they are not developing peak bone mass, and if they are elderly, that they are losing several percentiles of bone density yearly. Remember, intensity is relative to the individual. Meaning, just having a person start a walking program, and light resistance training program, not emphasizing explosiveness will have dramatic effects on their BMD. If the individual has very low bone density, be especially careful in their program. And I stress the word careful! You need to usher them slowly into exercise. Meaning even light movement will help. For the advanced athlete, this will not be enough. They will need to utilize explosive, high intensity training methods, if they want to enhance this area. And finally, stress to them the value of the nutritional aspects discussed in this article. Each of us can have a positive effect on the people around us. As The **Lord Jesus** said, " **if you do this to one of the least of my brethren, you have done it unto me** (19). "

### **Conclusion**

The past three articles were written and composed for the serious athlete! By following these principles you will turn your skeletal system into steal proofed armor! Your strength will increase, your health will abound, and those who oppose you will have to kindly step aside!

Yours In Sport

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