

**The Perils of Downhill Skiing with Bindings that Don't Release and, Surgeons who are not Privy to the Absolute Benefits of Vertical Water Training.
By Rob Duncan, CALA Certified**

A year ago I suffered a comminuted fracture of my tibia and fibula. I had an open reduction, internal fixation operation to stabilize the bits and pieces and begin the healing process.



Note: The pins and bars and screws in the x-ray on the right (post surgery) – OUCH!

The healing process took over 40 weeks; it was 24 weeks before I could fully weight bear, two to three times longer than what is considered normal. This delay was a result of age, genetics, disease and/or severity of the injury. It also gave me ample time, and a certain sense of urgency, to research what I could do to speed healing.

We know, as CALA certified instructors, that the tug of active muscle on bone enhances bone health. I had hoped to get into the water when the removable cast was put on my leg at week 12. Through my CALA training and education, I knew that moving in water, unloaded, in a suspended position would contribute to the healing process.

My surgeon had other ideas – no aqua fitness – and he was adamant. So, I began an extensive search to find academic, peer reviewed research that would show him the benefits of vertical water training on bone growth and the healing process. While I found a good deal of research, nearly all of it related to studies of osteoporosis involving post-menopausal women. I could find nothing on bone fractures and no



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studies on men. (Since women are twice as likely to suffer osteoporosis as men and are 4 times more likely to suffer osteoporotic fractures than men, this research focus makes a lot of sense.) Recently, however, I came across research by Professor B. Falk, now of McMaster University, who led a study of young males between 8 and 23 years of age. This study showed clearly that water based exercise enhances bone strength.

Abstract

Weight-bearing, high-impact exercise, as opposed to non-impact exercise, has been demonstrated to increase bone mineral density. This was traditionally demonstrated with dual energy X-ray absorptiometry. Our objective was to assess the differences in bone properties, using quantitative ultrasound (QUS, Sunlight Omni sense™, Sunlight Medical, Ltd., Tel Aviv, Israel), in male athletes involved in a weight bearing, impact sport (soccer, SC) or a non-impact sport (swimming and water polo, AQ), compared with non-athletic control (C) males.

A total of 266 boys and men, aged 8–23 years, were divided into children (11.1 ± 1.0 years; 34 SC, 34 AQ, 25 C), adolescents (14.7 ± 1.2 years; 32 SC, 31 AQ, 31 C), and young adults (19.8 ± 1.1 years; 31 SC, 24 AQ, 24 C). Training experience varied between 1.5 years in the children to 15 years in the adults. Bone speed of sound (SOS) was measured bilaterally at the distal radius and the mid-tibia.

Body fat was significantly lower in athletes compared with C (control). AQ (water) were generally heavier and had a higher fat-free mass compared with SC (soccer) and C, with no significant differences in height between groups. Radial SOS increased with age, but no differences were observed between activity groups or between the dominant (D) and non-dominant (ND) arm. Tibial SOS also increased with age. In the children and adolescents, no differences were observed between activity groups. However, **among adults, both SC and AQ had higher tibia SOS compared with C.** These differences were mainly explained by differences in fat-free mass. Among young adults but not among children and adolescent males, both soccer and aquatic sports appear to be associated with higher bone SOS in the lower, but not the upper, extremities. Further



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studies are needed to assess possible sport-specific mechanisms that affect bone properties and to determine the minimal cumulative effect needed to influence bone properties.

Other Conclusion in the Study

The main finding of this study is that while radial SOS measures did not differ between athletes and non-athletic controls, tibial SOS values were found to be significantly higher in the adult soccer players and aquatic athletes compared with controls.

No differences were observed between the aquatic athletes and soccer players in any of the age groups.

The higher tibial SOS values in the adult soccer players agree with previous DXA results of soccer players [5, 20, 25, and 40].



The higher tibial SOS values in the adult aquatic athletes contradict previous DXA results [1], but agree with previous reports of higher tibial SOS in female swimmers [11], suggesting that both aquatic sports *and* soccer may enhance both quantitative and qualitative properties of bone....

BMD, as measured by quantitative computed tomography (QCT), is volumetric density (tri-dimensional). Block et al. [4] used QCT to assess hip and spinal BMD in adult male water polo players and weight-training athletes. They reported no difference in volumetric BMD between the two groups of athletes, both of which had higher BMD compared with the control, non-athletic group. Thus, DXA, while the accepted method of evaluating bone strength in humans, may not reflect all aspects of bone properties that contribute to bone strength.

Swimming may affect bone properties other than bone mineral density, such as elasticity or the micro-architecture.... Indeed, several intervention studies in animals have clearly demonstrated that **swimming can have a positive effect on bone properties such as elasticity [17] and structural strength [18, 32], as well as on BMD.**



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That is, swimming resulted in geometric adaptations (greater periosteal and endocortical areas), which were reflected in greater bone strength (polar moment of inertia and strength strain index), but not in enhanced BMD.

Summary

As often is the case, this study suggests the need for further study. Water exercise can play an important role in health and wellness not only on muscles, heart and lungs but also, as this work reaffirms, on bones. It is important for us lay people to recognize that bone mineral density (BMD) is but one measure of bone strength. When other measuring techniques are used, water based programs are as effective as land based exercise when it comes to the lower half of one's skeleton. It is clear from these authors' work that exercise does not differentiate between sexes nor between various age groups.



Rob's Aside: You don't have to be a broken old man to benefit from aqua fitness.

Edited by Charlene Kopansky, CALA Founder and President - April 2009

Biography of Rob Duncan: Rob is a retired investment analyst now working as a consultant to business and as an instructor in sports and fitness. A certified ski instructor with 30 years of teaching experience, Rob decided to switch careers when he retired from full time business. So five years ago he began his education in fitness with a focus on Older Adult fitness. He qualified as a CALA instructor, a Personal Trainer and Older Adult Specialist, Twist Sports Conditioning Specialist and Fitness Kickboxing Instructor. He works part time as an Aquafit instructor in the summer, a ski instructor in the winter and his is accepting substitute assignments that come his way.