

Concurrent Session 1: Nutrition for Childhood and Adolescence

Making strong bones – leaning towards what really matters

CFJ Munns

Institute of Endocrinology and Diabetes, Department of Nuclear Medicine, The Children's Hospital at Westmead, NSW, 2145 & Department of Paediatrics, University of Sydney, NSW

Background – Bones develop to withstand the mechanical forces applied to them from muscle pull and growth (1). Heritable factors account for up to 80% of the variance in bone mass (2). Of the modifiable factors, physical activity, lean tissue mass and dietary calcium intake that have been extensively evaluated. After genetics, physical activity appears the major determinant of peak bone mass, accounting for up to 17% of its variance (3).

Objective – To discuss the major modifiable factors of bone strength including physical activity, lean tissue mass and dietary calcium intake.

Design – Review of the literature on modifiable factors of bone strength.

Outcomes – Bone mineral density testing has shown that muscle mass is a major predictor of bone mineral content (BMC) (4). This is seen in children with reduced ambulation, where reduced lower limb bone and muscle mass co-exist (1). In healthy children, physical activity can positively influence bone mass (5), but this is not maintained once activity is ceased (3). Mechanical stimulation of bone through vibration takes advantage of the anabolic effects of muscle stimulation on bone (6).

There are no data on the minimum threshold of calcium intake required for optimal bone health during childhood (7). Studies into calcium supplementation have lacked adequate control groups to account for the multiple factors influencing bone and none have assessed bone strength (7). Further, calcium's effect appears short lived, with very few studies showing a prolonged benefit on bone mass. Milk calcium may be more important than calcium salts, as milk may also provide essential proteins and growth factors necessary for bone development (3).

Conclusion – As more is done to unravel the modifiable influences on bone strength, it appears that the greatest promise lies with the development and maintenance of optimal physical activity and thus lean tissue mass.

References

1. Munns CF, Cowell CT. Prevention and treatment of osteoporosis in chronically ill children. *J Musculoskeletal Neuronal Interact* 2005;5(3):262-72.
2. Bachrach LK. Acquisition of optimal bone mass in childhood and adolescence. *Trends Endocrinol Metab* 2001;12(1):22-8.
3. Davies JH, Evans BA, Gregory JW. Bone mass acquisition in healthy children. *Arch Dis Child* 2005;90(4):373-8.
4. Hogler W, Briody J, Woodhead HJ, Chan A, Cowell CT. Importance of lean mass in the interpretation of total body densitometry in children and adolescents. *J Pediatr* 2003;143(1):81-8.
5. McKay HA, MacLean L, Petit M, MacKelvie-O'Brien K, Janssen P, Beck T, et al. "Bounce at the Bell": a novel program of short bouts of exercise improves proximal femur bone mass in early pubertal children. *Br J Sports Med* 2005;39(8):521-6.
6. Ward K, Alsop C, Caulton J, Rubin C, Adams J, Mughal Z. Low magnitude mechanical loading is osteogenic in children with disabling conditions. *J Bone Miner Res* 2004;19(3):360-9.
7. Lanou AJ, Berkow SE, Barnard ND. Calcium, dairy products, and bone health in children and young adults: a reevaluation of the evidence. *Pediatrics* 2005;115(3):736-43.