

# THE ROLE OF PHYSICAL ACTIVITY ON BONE DENSITY AND BONE GEOMETRY IN MEN

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av

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Avhandlingen baseras på följande delarbeten:

- I Physical Activity is the Strongest Predictor of Calcaneal Peak Bone Mass in Young Swedish Men**  
Pettersson U.\*, Nilsson M.\*, Sundh V., Mellström D., and Lorentzon M.  
\*Contributed equally to this work  
*Osteoporosis International. 2010 Mar; 21(3):447-55*
- II Previous Sport Activity during Childhood and Adolescence is Associated with Increased Cortical Bone Size in Young Adult Men**  
Nilsson, M., Ohlsson, C., Mellström, D., and Lorentzon, M.  
*Journal of Bone and Mineral Research. 2009 Jan;24(1):125-33*
- III Competitive Physical Activity Early in Life is Associated with Bone Mineral Density in Elderly Swedish Men**  
Nilsson, M., Ohlsson, C., Eriksson, AL., Frändin K., Karlsson, M., Ljunggren, Ö., Mellström, D., and Lorentzon, M.  
*Osteoporosis International. 2008 Nov;19(11):1557-66*
- IV Association of Physical Activity With Trabecular Microstructure and Cortical Bone at Distal Tibia and Radius in Young Adult Men**  
Nilsson, M., Ohlsson, C., Sundh, D., Mellström, D., and Lorentzon, M.  
*Journal of Clinical Endocrinology & Metabolism [Accepted for publication]*

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## ABSTRACT

**Introduction:** Several studies indicate that peak bone mass, reached during the third decade in life, is an important determinant of osteoporosis later in life. Physical activity with dynamic loading of the bone is an important determinant of peak bone mass. Exercise especially before and during puberty is associated with increased bone density and cortical bone size in children and young adults. It has, however, not been established for how long this alteration will remain if the level of physical activity is decreased or ceased. Furthermore, the previously used technology in measuring bone mass has not been able to explain how physical activity influences bone microarchitecture that can affect bone strength and resistance to fracture in humans.

**Objective:** The overall aim of this thesis was to gain a better understanding of the role of physical activity and inactivity on bone density, bone geometry, and trabecular microarchitecture in men.

**Methods:** Four large and representative cohorts, three with young adult men and one with elderly men, were used in these population-based, cross-sectional studies. Data concerning physical activity was collected using standardized questionnaires. Bone parameters were assessed using dual-energy X-ray absorptiometry (DXA) for areal bone mineral density, peripheral quantitative computerized tomography (pQCT) for volumetric bone mineral density and bone geometry, and high resolution 3D pQCT for trabecular microarchitecture.

**Results:** In a large cohort of young adult men (age 18, n=2,384), history of physical activity was the strongest predictor of calcaneal bone mineral density. Calcaneal bone mineral density was also higher in those who had ceased to be active compared to those who had always been inactive. In a cohort of young physically inactive men (age 19, n=367), previous sport activity was independently associated with cortical bone size of the tibia at the age of 19 years. Subjects, who ceased their sport activity for up to 6.5 years previously, still had larger cortical bone size of the tibia than always inactive subjects. In a large cohort of elderly men (n=498), we found that high frequency of competitive sports during the first three decades in life was independently associated with bone mineral density at several bone sites at the age of 75 years. In a large sample of young adult men (age 24, n=829), we found that the degree of mechanical loading due to type of present physical activity independently predicted trabecular volumetric bone density and trabecular number and that duration of previous physical activity independently predicted cortical cross-sectional area in the tibia.

**Conclusions:** The findings in this thesis indicate that physical activity during growth plays an important role in the enhancement of peak bone mass and bone geometry even though physical activity is ceased, suggesting that physical activity during growth confers a lasting positive effect on bone and can contribute to the prevention of bone loss in men. We also demonstrated that the degree of mechanical loading due to type of present physical activity was predominantly associated with trabecular microstructure in weight-bearing bone.

**Keywords:** bone mineral density, bone geometry, trabecular microarchitecture, physical activity, men