

## **Physical Activity in Late Prepuberty and Early Puberty is Associated with High Bone Formation and Low Bone Resorption**

Jakob Rempe<sup>1,2</sup>, Björn E. Rosengren<sup>2,3</sup>, Lars Jehpsson<sup>2,3</sup>, Per Swärd<sup>2,3</sup>, Magnus Dencker<sup>4</sup>, Magnus K. Karlsson<sup>2,3</sup>

<sup>1</sup> Department of Orthopedics, Helsingborgs Hospital

<sup>2</sup> Clinical and Molecular Osteoporosis Research Unit, Lund University

<sup>3</sup> Department of Orthopedics, Skane University Hospital

<sup>4</sup> Department of Physiology and Clinical Science, Skane University Hospital

**Background:** Physical activity (PA) increases bone mass, especially during late pre- and early puberty (Tanner stages 1–2). It is however unclear if the effect is mediated through changes in bone formation, bone resorption or both.

**Method:** In a PA intervention study we followed 349 children, age  $7.7 \pm 0.6$  (mean $\pm$ SD) during all nine compulsory school years. The intervention group (n=217) received 40 minutes of daily school PA (200 minutes/week) while controls (n=132) received the national standard of PA 1-2 times/week (60 minutes/week).

We analyzed serum bone formation markers [bone-specific alkaline phosphatase (bALP), osteocalcin (OC) and N-terminal propeptide of collagen type 1 (PINP)] and resorption markers [C-terminal telopeptide cross links (CTX) and tartrate-resistant acid phosphatase (TRAcP 5b)], during and after the intervention.

**Results:** After two years of intervention children in Tanner 1–2 who received intervention had higher bone formation [bALP +13.7  $\mu$ g/L (2.1, 25.3) (mean (95%CI)) and OC +9.1  $\mu$ g/L (0.1, 18.1)] and lower bone resorption [TRAcP 5b -2.3 U/L (-3.9, -0.7)] than controls. We found similar bone formation/resorption with ongoing intervention in Tanner 3–5 (age  $14.8 \pm 0.8$ ), and after termination of the intervention in Tanner 5 (ages  $18.8 \pm 0.3$  and  $23.5 \pm 0.7$ ).

**Conclusion:** Daily school PA during late pre- and early puberty is associated with higher bone formation and lower bone resorption than school PA 1-2 times/week. Later in puberty and after intervention, formation and resorption were similar in the intervention group and controls. This indicates that pediatric PA induced bone mass benefits may remain into adulthood.