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Abstract

How Different Loading Sports and a 9-Month Plyometric Intervention Programme Affect Bone Turnover Markers During Adolescence: The PRO-BONE Study †

D. Vlachopoulos [1,*], A. R. Barker [1], C. A. Williams [1] and L. Gracia-Marco [2,3]

[1] Children's Health and Exercise Research Centre, Sport and Health Sciences Department, University of Exeter, Exeter EX1 2LU, UK; A.R.Barker@exeter.ac.uk (A.R.B.); C.A.Williams@exeter.ac.uk (C.A.W.)

[2] "PROmoting FITness and Health Through Physical Activity" Research Group, Sport and Health University Research Institute (iMUDS), Department of Physical Education and Sport Faculty of Sport Sciences, University of Granada, 18016 Granada, Spain; lgracia@ugr.es

[3] Growth, Exercise, Nutrition and Development Research Group, Universidad de Zaragoza, 50005 Zaragoza, Spain

* Correspondence: D.Vlachopoulos@exeter.ac.uk

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Abstract: Aim: The purpose of the present study was to (1) investigate the cross-sectional (baseline) and longitudinal (12 months) effects of football (weight-bearing sport), swimming and cycling (non-weight-bearing sports), and an active control group on bone turnover markers in adolescent males and (2) examine the effect of a 9-month progressive jumping intervention programme on bone turnover in the sports groups of adolescent males. **Materials & Methods:** A total of 105 adolescent males (30 footballers, 37 swimmers, 26 cyclists, and 12 active controls), aged 12 to 14 years at baseline, were measured at baseline (T0), after 1 year of sport-specific training (T1) and following a 9-month progressive jumping intervention programme (T2). Bone turnover was measured using serum *N*-terminal propeptide of procollagen type I (PINP) as bone formation marker and isomer of the carboxy-terminal telopeptide of type 1 collagen (CTX-I) as bone resorption marker. Bone turnover rate and balance were estimated using the multiple of medians logarithmic equations of PINP and CTX-I. **Results:** At T0 there were no significant differences between groups in any of the biochemical markers. At T1 PINP was significantly higher in footballers than swimmers (3.3%) and cyclists (6.0%). Cyclists had significantly lower PINP (5.1%) and CTX-I (14.8%) than controls. In swimmers, there was a significant decrease in PINP (5.8%) and a significant increase in CTX-I (9.8%) from T0 to T1. In cyclists, PINP significantly decreased (7.2%) and CTX-I non-significantly increased (4.3%) from T0 to T1. At T2, PINP was reduced in all non-intervention sport groups (4.4% in swimmers, 3.3% in footballers, and 4.2% in cyclists). CTX-I was reduced by 3.8% in swimmers and cyclists who did not perform the intervention. **Conclusions:** The present study showed that at baseline there were no differences between groups in bone turnover, but after 1 year of sport-specific training bone turnover was significantly improved in footballers and controls compared to swimmers and cyclists. Following the 9-month jumping intervention bone turnover significant declined in the intervention groups of cycling and swimming. By contrast, bone formation significantly decreased in footballers and the control groups, and bone resorption significantly decreased in the non-intervention groups of cycling and swimming.

Keywords: bone turnover; plyometric training; weight-bearing sports