**The Bone Research Society Barbara Mawer Travelling Fellowship 2019 Report**

**Dr Dimitris Vlachopoulos visited the University of Eastern Finland**

**Project title: The longitudinal effects of physical activity and nutrition on musculoskeletal outcomes and biomarkers of body composition from childhood to adolescence. The PANIC study.**

## Introduction

Firstly, I would like to express my honest gratitude to the Bone Research Society for the support provided over the years and for this Fellowship. The Barbara Mawer Travelling Fellowship allowed me to develop my research skills and extend my professional network. Specifically, the Fellowship resulted in learning about the use of biomarkers and advanced statistical techniques which both helped me to enhanced my research profile and plan my future research projects as independent researcher.

## Background of the project

My project aimed to examine role of physical activity and nutrition on bone health in children and understand the contribution of metabolic biomarkers with bone and body composition outcomes.

Previous research indicates that childhood and adolescence are periods of rapid growth and development of the musculoskeletal system. The factors affecting peak bone mass during growth include non-modifiable factors, such as genetics (Bonjour, Chevalley, Rizzoli, & Ferrari, 2007), and modifiable factors, such as nutrition (e.g. calcium and vitamin D) (Chevalley, Bonjour, Ferrari, Hans, & Rizzoli, 2005) and physical activity (Janz et al., 2014; Tobias, Steer, Mattocks, Riddoch, & Ness, 2007). The peak accrual in bone and lean mass occurs during the years surrounding peak height velocity, indicating the importance of this period of life for bone health (Baxter-Jones, Faulkner, Forwood, Mirwald, & Bailey, 2011). Physical activity during childhood is beneficial for bone development and the benefits can be sustained into adolescence and young adulthood (Baxter-Jones, Kontulainen, Faulkner, & Bailey, 2008; Janz et al., 2010). Previous cross-sectional evidence indicates that the recommended minimum of indicates that 28-32 minutes per day of vigorous physical activity could induce positive BMD at the hip and intertrochanteric skeletal sites in adolescence (Gracia-Marco et al., 2011). However, the optimal amount of physical activity and nutrition that can be beneficial for bone development during childhood and adolescence are not clear.

Physical activity and nutrition interact to improve bone development and evidence suggests that a 12-month physical activity and calcium supplementation intervention improved bone mineral content (BMC) and bone strength in 3 to 5 old children (Specker & Binkley, 2003). In addition to the physical activity and nutrition relationship with bone growth, adipose tissue and skeletal muscle may affect bone adaptations. Metabolic biomarkers, such as leptin, adiponectin, insulin-like growth factor I (IGF-1), interleukin 6 (IL-6) and plasma high-sensitivity C-reactive protein (hsCRP) found to be important mediators in the relationship between physical activity and nutrition with bone development during growth (Brotto & Bonewald, 2015; Soininen et al., 2018).

## Results obtained and skills learned

I undertook this research project at University of Eastern Finland, Institute of Biomedicine in Kuopio and Jyväskylä cities in Finland. I have worked with Prof Timo A. Lakka as part of the 8-year Physical Activity and Nutrition in Children (PANIC) study (ClinicalTrials.gov registration number NCT01803776). The setting of the PANIC study consists of clinicians, statisticians, epidemiologists and academic scientists. This setting was really valuable from a mentorship and also from study design perspective. The data of the PANIC study includes cross-sectional, 2-year randomised control trial intervention and 8-year follow-up data in a population sample of children aged 6-8 years. Participants completed the baseline (506), 2-year (440) and 8-year (280) visits.

For 2-year the intervention part, the children and their parents allocated to the intervention group had 6 dietary counselling sessions of 30–45 minutes and 6 physical activity counselling sessions of 30–45 minutes during the 2-year intervention period. The dietary and physical activity counselling sessions occurred at 0.5, 1.5, 3, 6, 12, and 18 months after baseline. I have used the Dual energy X-ray absorptiometry (DXA) data to assess BMD (g/cm2), lean mass (g) and fat mass (g) at total body less head, arms and legs skeletal sites. Also, I had a really valuable experience of observing the analysis of metabolic biomarkers of body composition in the present project. The following biomarkers are used as part of the reseach project: leptin, leptin receptor, irisin, adiponectin, insulin-like growth factor I (IGF-1), interleukin 6 (IL-6), plasma high-sensitivity C-reactive protein (hsCRP) and 25-hydroxyvitamin D (25[OH]D). In addition, I had the opportunity to present data as part of my PhD and the PRO-BONE study to the host research group and transfer my expertise of using new approaches of bone geometry, such as the Hip Structural Analysis (HSA) software at the femoral neck, and the trabecular bone score at the lumber spine. Finally, I have learned new statistical techniques, such as the Receiver Operating Characteristic (ROC) curve using MedCalc software to identify the optimal amount of physical activity and nutrition for musculoskeletal development.

## How the new skills and knowledge will be incorporated into your own research

Overall, this Fellowship has been really useful and rewarding for my professional career as independent researcher because I have learned new skills that I can employ in my current research. These techniques will advance my career and will allow me to extend my scientific output by collaborating with the host research group. Additionally, I plan to use both the metabolic biomarker techniques and the statistical techniques learned to future research projects and specifically to quantify and examine the association of physical activity and nutrition with bone health during growth as part of the PANIC and ALSPAC studies. I have extended my professional network by making new contacts with senior researcher and mentors that may lead to future potential collaborations. I would like to thank again the BRS for this opportunity and I hope that my experience outlined here provides the evidence for future young researchers about the benefits of being part of the Society and encourage them to engage with the Society and receive the generous and unique support offered.

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