INTRODUCTION:

- Endurance runners tend to have high total and/or loading site-specific bone mineral density (BMD) (Scofield & Hecht, 2012).
- BMD is approximately 50-85% heritable (Ralston & Uitterlinden, 2010).
- Little is known about which specific genes are involved, whether particular genotypes are sensitive to mechanical loading and the impact of such an interaction on BMD.
- This study investigated if high-level endurance runners possess enhanced BMD associated with an “advantageous” genetic predisposition, via a potential gene-training interaction.
BONE MINERAL DENSITY AND ASSOCIATED GENETIC VARIANTS IN HIGH-LEVEL CAUCASIAN MARATHON RUNNERS

Herbert, A.J.¹, Williams, A.G.¹, Lockey, S.J.¹, Erskine R.M.², Sale, C.³, Hennis, P.J.², Antrobus, M.R.¹,²,³, Brazier, J.¹,², Heffernan, S.M.₄, Day, S.H.¹ & Stebbings, G.K.¹

¹MMU, Crewe, UK, ²LJMU, Liverpool, UK, ³NTU, Nottingham, UK, ⁴UCD, Dublin, Ireland, ⁵UCL, London, UK, ⁶UON, Northampton, UK, ⁷UH, Hatfield, UK.

METHOD:

• Total BMD (TBMD) and leg BMD (LBMD) measured via Dual-energy X-ray absorptiometry in 68 high-level Caucasian marathon runners (males < 2 h 45 min, n = 37; females < 3 15 min, n = 31) was compared with 45 male and 41 female non-athletes.

• Specific genetic variants were then investigated singularly, and collectively, as a total genotype score (TGS) via multivariate analysis of variance.

<table>
<thead>
<tr>
<th>LRP5 rs3736228</th>
<th>LDL receptor-related protein 5</th>
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<tr>
<td>TNFRSF11B rs4355801</td>
<td>TNF receptor superfamily member 11b (Osteoprotegerin)</td>
</tr>
<tr>
<td>VDR rs2228570</td>
<td>vitamin D (1,25- dihydroxyvitamin D3) receptor</td>
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<tr>
<td>WNT16 rs3801387</td>
<td>Wnt family member 16</td>
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<tr>
<td>AXIN1 rs9921222</td>
<td>axin 1</td>
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RESULTS:

In males, runners had ~7% higher TBMD (1.33 vs 1.28 g/cm²; *P<0.05) and LBMD (1.53 vs 1.43 g/cm²; *P<0.01) than non-athletes.

In females, runners had ~10% higher TBMD (1.24 vs 1.16 g/cm²; *P<0.01) and LBMD (1.32 vs 1.19 g/cm²; *P<0.01) than non-athletes.

For VDR rs2228570, ff genotype was associated with higher TBMD in female runners but lower TBMD in female non-athletes suggesting an interaction between genotype and physical training load (*P<0.04).

No other interactions or variants, individually or collectively as part of a TGS, were associated with BMD (*P>0.10).
CONCLUSION:

• High-level male and female runners possess both higher TBMD and LBMD in comparison with non-athletes.

• Consistent with most prior literature, higher BMD was observed in VDR rs2228570 FF and Ff genotypes in non-athletes, which may be due to increased biological activity associated with the F variant (Arai et al., 1997; Yasovanthi et al., 2011).

• However, our preliminary data suggest the ff genotype may be associated with enhanced TBMD in female runners via interaction with the high volume of (bone stimulating) training conducted, i.e. a gene-environment interaction.