Association between MAPT polymorphism but not APOE promoter and elite rugby athlete status.


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Introduction

Incidence and outcomes of concussions have been hypothesised to be genetically influenced. Within rugby, the primary mechanical stress injury to neurons is often a result of a collision and can initiate the secondary (delayed) injury of a neurometabolic cascade, resulting in neuropathologic events. The APOE promoter G219T (rs405509) polymorphism has been associated with differential promoter activity and unfavourable outcomes after traumatic brain injury. The TT genotype has been associated with a 3-fold greater risk of multiple concussions. The TT genotype of MAPT (rs10445337) has also been associated with poorer outcomes after concussion, potentially due to the formation of neurotoxic neurofilibrillary tangles. Rugby has one of the highest incidences of concussion in sport, so it was hypothesised that APOE promoter TT and MAPT TT genotypes would be less prevalent in elite rugby athletes because those genotypes, previously associated with increased risk, would be less compatible with achieving elite athlete status.

Method

Participants were from the RugbyGene project, comprising elite Caucasian male rugby athletes (n = 528; mean (standard deviation) height 1.85 (0.07) m, mass 101 (14) kg, age 29 (7) yr), including 420 rugby union (RU) athletes that for some analyses were divided into forwards and backs and 108 rugby league (RL) athletes. Non-athletes were 592 Caucasian men and women (57% male, height 1.72 (0.10) m, mass 74 (14) kg, age 31 (7) yr). PCR of genomic DNA was used to determine genotypes using TaqMan probes, then groups were compared using χ² and odds ratio (OR) statistics.

Results

All genotype data were in Hardy-Weinberg equilibrium. For MAPT (rs10445337), the risk genotype (TT) was underrepresented in rugby athletes (60%) compared to non-athletes (66%), CT more common in rugby athletes (34%) than non-athletes (29%) and little difference in CC genotype frequencies (χ² = 7.092, P = 0.029; TT genotype frequency OR = 0.80, 95% confidence intervals (CI) = 0.62-1.02). There were no differences in MAPT (rs10445337) genotype frequencies between RU forwards and backs (Fig 1). For APOE promoter G219T (rs405509), there were no differences in genotype frequencies between all athletes (RU and RL) and non-athletes (27% TT genotype in players and non-athletes), nor between RU forwards and backs (Fig 2).

Fig. 1 MAPT (rs10445337) genotype frequencies. * Different from Non-athletes (P = 0.029)

Fig. 2 APOE promoter G219T (rs405509) genotype frequencies

Conclusion

The MAPT (rs10445337) TT genotype is 6% less common in elite rugby athletes than non-athletes. Therefore, carrying at least one rs10445337 C allele appears to increase the probability of sustained career success in the high-risk concussion environment of elite rugby, perhaps via a greater ability to recover from concussions.

References


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