Titin genotype is associated with skeletal muscle fascicle length in recreationally active men and running performance in habitually trained marathon runners

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ABSTRACT

Objectives: The titin gene (*TTN*) encodes the largest described protein to date and, due to its size, provides a molecular blueprint for the organisation and assembly of the muscle sarcomere. Differences in sarcomere length, due to the expression of different titin isoforms, have been observed previously and may influence muscle fascicle length, which could provide an advantage for running performance. Thus, the aim of this study was to investigate if the *TTN* rs10497520 polymorphism was associated with muscle fascicle length in recreationally active men and marathon personal best time in elite male marathon runners, and to investigate any differences in genotype frequency between RA and MR.

Methods: The sample comprised 278 healthy, unrelated Caucasian men who all gave written consent to take part. Participants were categorised as either recreationally active [RA; n = 137; age = 20.7 (2.7) yr; height = 1.79 (0.06) m; mass = 75.3 (10.1) kg] or marathon runners [MR; n = 141; age = 34.9 (7.8) yr; height = 1.79 (0.07) m; mass = 66.5 (6.7) kg]. MR comprised Olympic, international and national level athletes, who had all achieved marathon personal best times under 2 hr 36 mins. Resting fascicle length of the vastus lateralis muscle was assessed in vivo using B-mode ultrasonography at 50% of muscle length in RA only. All participants provided either a whole blood, saliva or buccal cell sample, from which DNA was isolated and genotyped using real-time polymerase chain reaction. Independent samples t-tests were used to determine any genotype-dependent differences in fascicle length in RA and marathon personal best time in MR. Pearson's chi-square tests were conducted to compare genotype frequencies between RA and MR.

Results: Vastus lateralis fascicle length was 10.4% longer in CC homozygotes than CT heterozygotes (P = 0.003) in RA. In the absence of any TT homozygotes, reflective of the low T-allele frequency within Caucasian populations, it is unclear if fascicle length for this group would have been smaller still. No differences in genotype frequency between the RA and MR groups were observed (P = 0.500), however, within the MR group the T-allele carriers demonstrated marathon personal best times 2 min 25 s faster than CC homozygotes (P = 0.020).

Conclusions: These results suggest that the T-allele at rs10497520 in the *TTN* gene is associated with shorter skeletal muscle fascicle length and conveys an advantage for marathon running performance in habitually trained men.

Keywords: Endurance athletes, fascicle length, gene polymorphism, mechanical efficiency, titin.